EM
EFFICIENT MANUFACTURING
13th ANNIVERSARY
www.industr.com/en
publish industry India
VOL 14 – Issue 01 | NOVEMBER 2022 (Monthly) | ₹ 100

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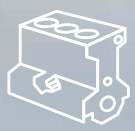
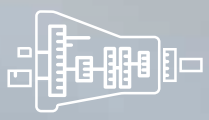

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"EM completes 13 years of its knowledge platform!"

Capturing industry milestones and keeping the promise…

In recent years, India has become the fastest-growing economy in the world. This fast growth has accelerated the industry landscape to the next level. According to reports, India is an attractive hub for foreign investments in the manufacturing sector. Several manufacturing industries and automobile brands, have set up or are looking to establish their manufacturing bases in the country. The manufacturing sector of India has the potential to reach $ 1 trillion by 2025.

Today's economies are dramatically changing, triggered by development in emerging markets, the accelerated rise of new technologies, sustainability policies, and changing consumer preferences around ownership.

Around such a dynamic market canvas, what is significantly important is to adapt to the ever-changing business circumstances. Here lies the importance of a pragmatic leader within an organisation. Keeping this in mind, we are delighted to feature Leadership Insights from some of the top leaders of the industry as EM turns 13 with this anniversary issue. While India is at the peak of its revolution, our anniversary edition Cover Story is a take on how some big giants of the industry have evolved over the years and how they have responded to the massive technological boom in the Indian industry with their thought leadership in the industry.

As EM completes 13 years of the best-of-knowledge platform that we could offer, we would like to extend our heartfelt thanks to all those who supported us on the journey to our success: our advertisers, contributors, advisory board members, partners, and most importantly, our readers. On its way forward, EM will continue capturing and circulating relevant content, facilitating manufacturing enterprises, and identifying and applying technology upscaling strategies to transition their businesses forward towards an intuitive future.

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SAP launches industry knowledge exchange Amrit Kaal

SAP India in collaboration with Amazon Web Services (AWS), recently announced the launch of SAP Industry Knowledge Exchange (SAP IKEX), which aims at accelerating India's journey to Amrit Kaal, and driving the country's inclusive digital transformation with sustainable development. IKEX will bring together academia, cloud partners, and customers to exchange ideas, experiences, and best practises to drive inclusive digital transformation and sustainable development in the country. Also, it will cover 25 industries, including auto and manufacturing, CPG retail, life sciences, start-ups and unicorns, and many more. The exchange will bring together enterprises, consulting firms, and academia from various industries to enable technological co-innovation, the sharing of best practices, and deliberation on regulatory policies. During the launch, Kulmeet Bawa, President & Managing Director, SAP Indian Subcontinent, said, "We want to enable corporates in creating business networks that allow various industries to interact and achieve uniform growth across the entire value chain. With the IKEX Platform our objective is to empower Indian enterprises, while also gathering pertinent information in real-time to be ready for potential disruptions."

EFIM Ente Fiere Italiane Macchine conducts BI-MU

EFIM Ente Fiere Italiane Macchine recently organised BI-MU, the biennial exhibition of machine tools, robotics, automation, and digital and Additive Manufacturing, which culminated in its 33rd edition, was held at Fiera Milano Rho on October 12, 2022. It was promoted by UCIMU-SISTEMI PER PRODURRE, the Italian machine tool, robot, and automation systems manufacturers' association. 33.BI-MU showcased international products of the sector, the expression of almost 700 exhibiting companies, of which 37% were from abroad, occupying a total surface area of 65,000 sq mt in the four halls set up for the event. Also, there were 100 operators, mostly end users, in addition to several journalists, coming from 13 countries - Australia, Bosnia-Herzegovina, Brazil, Canada, Croatia, and India, among the others invited within the business mission organised by UCIMU-SISTEMI PER PRODURRE in cooperation with ICE-Italian Trade Agency & the Ministry of Foreign Affairs and of International Cooperation. Addressing the event, Alfredo Mariotti, General Manager, UCIMU-SISTEMI PER PRODURRE, stated: "Witnessing a huge crowd is a sign that the proposal of this BI-MU met the approval of the public. If compared with the 2018 edition, the last one before the pandemic, 33.BI-MU was more successful."

ABB India has been awarded as 'Pioneer in large scale adoption of Green Factory Buildings in India' by Indian Green Building Council

ABB India recently announced that it has been conferred with the 9th Indian Green Building Council (IGBC) Green Champion Award under the category of 'Pioneer in large-scale adoption of Green Factory Buildings in India.' The company was felicitated at the IGBC Leadership Awards Programme, part IGBCs' flagship event, the 20th Green Building Congress, in Hyderabad. The annual Green Champion Award is bestowed by IGBC, part of the Confederation of Indian Industry (CII), to recognise and honour organisations that have embraced sustainable goals and have the potential to inspire others, thereby advancing the Green Building Movement in India. During the felicitation, Sanjeev Sharma, Country Head and Managing Director, ABB India, asserted, "Four out of our five manufacturing locations have been certified as Green Factory Buildings by the IGBC. We intend to adopt sustainable ways not only for our own processes and buildings but also to help our associates achieve their sustainability goals."

Dassault Systèmes and Verkor sign an MoU to advance low-carbon battery development and manufacturing

Dassault Systèmes has announced the signing of a Memorandum of Understanding (MoU) with Verkor, to accelerate the development of next-generation lithium-ion batteries and the first gigafactory that will produce them. The two companies aim to nurture a European battery ecosystem that supports Europe's efforts to achieve climate neutrality by 2050. On this collaboration, Christober Raj, Head of Digital, Verkor, stated, "Our collaboration with Dassault Systèmes will enable us to address the end-to-end product lifecycle process with the 3DEXPERIENCE platform." Dassault Systèmes' 3DEXPERIENCE platform and transformative knowledge and know-how across the high-tech, transportation and mobility, and energy and materials industries will be the catalysts for establishing new methodologies and ways to innovate sustainably in areas such as product, process, and flow simulation, supplier collaboration, and total quality management. Addressing the occasion, Stéphane Sireau, Vice President, High-Tech Industry, Dassault Systèmes, "Our 3DEXPERIENCE platform and our battery sector solutions empower battery innovation, from their chemistry definition to the design and engineering of the most advanced gigafactory."

Vitesco Technologies advances key function of electric driving

Vitesco Technologies has recently won several orders worth more than 2 billion euros for its innovative Battery Management Systems (BMS). Its significant contracts will deliver a wireless communication version of the battery control units for BEV architectures of 400 V and 800 V. This innovative solution reduces the amount of cabling inside the battery, saving space and improving range capacity through the use of either a larger battery or by reducing the size and weight of the battery. Intelligent BMS solutions consisting of control units, sensors, and application software protect the battery against overheating and ensure a balanced charging state of all cells. This is essential for safe operation and long battery life. Expressing thoughts over the profitable growth, Thomas Stierle, Member Executive Board and Head Electrification Technology and Electronic Controls business units, Vitesco Technologies, said, "With our modular software and hardware for battery management we can offer our customers tailor made solutions. In addition, innovations such as wireless communication with the battery modules enable advanced battery design, leading to reduced system costs for our customers."

Statiq and Mahindra to collaborate for EV infrastructure solutions

Statiq has forged an e-mobility partnership with India's SUV manufacturer, Mahindra & Mahindra (M&M). The alliance between Statiq and M&M will provide EV users with a robust, accessible, affordable, and reliable mobility network across the country. The two companies will also collaborate on various e-mobility technology integration projects in the future. With this alliance, Statiq further bolsters its plans to be able to promise users in the EV ecosystem stress-free travel and the option to always #StayCharged. Mahindra & Mahindra partnership with Statiq will ensure robust EV infrastructure solutions in the most seamless manner. It will enable faster charging and a wider reach through our extensive dealership network across the country. Statiq aims to provide an end-to-end ecosystem for EV chargers and to assure everybody that, whether it's within their town or city, or on long drives over weekends and holidays, a Statiq EV charging station will always be at hand. Hence, just last month, Statiq announced a collaboration with EV maker Ather, to enhance the combined EV charging network.

Siemens & Eplan to strengthen collaboration in the software solutions industry

Siemens Smart Infrastructure and **Eplan** have signed a strategic partnership to strengthen collaboration in the area of software solutions for the industry and infrastructure market segments. As part of this agreement, Siemens' Electrical Products business unit will join the Eplan Partner Network as a strategic partner. The objective is to coordinate the products of both companies in a more targeted manner in order to offer optimized solutions for switchgear manufacturers and electrical planners. This partnership will enable co-operation in the industry and infrastructure market segments also optimise solutions for switchgear manufacturers and electric partners. Emphasising the benefits for joint customers, Andreas Matthé Sebastian Seitz, Eplan, asserted, "The overall goal of our collaboration is to create a plug-and-play structure for electrical planners. In switchgear construction, we can use Eplan Pro Panel to optimise processes and automate them to a greater extent. We will also address the growing area of power distribution and work with Siemens to create end-to end solutions for integrative, more efficient workflows."

STL becomes the world's first optical manufacturer to be 'Zero Liquid Discharge' certified

Sterlite Technologies (STL) announced that 100% of its Indian manufacturing facilities are now Zero Liquid Discharge (ZLD) certified by Deutsch Quality Systems (DQS India). While India only has 4% of the world's freshwater reserves at present, the demand will rise by over 70% by 2025. For STL, water management is a top priority in its materiality matrix. This has led STL to develop water-resilient communities and undertake rainwater harvesting and technology interventions to optimise water demand and adhere to stringent ZLD protocols. At STL, the water management process is carried out through Sewage Treatment Plant (STP), Effluent Treatment Plant (ETP), and Multi-effective Evaporator (MEE) plants. The ZLD process involves an in-depth understanding of the liquid waste profiles and in-plant modifications to minimise water usage. The wastewater is chemically treated to remove chlorine and solid particles. It then undergoes three-tiered centrifugation to remove salt and suspended particles, making it fit for reuse in boilers and scrubbers. The entire process is digitally monitored using a Supervisory Control and Data Acquisition (SCADA) architecture and shift dashboards.

Stalwarts of the Industry & their Exemplary Leadership

A discursive path of leading the industry always invites great minds and the ability to make a buzz in situ scenarios. The dynamic market canvas speaks how competitive the industry has become and to keep the wheels moving requires efficacy to direct the development which comes along the ever-evolving scenarios. Here comes the importance of pragmatic leader within an organisation. We are gratified to interview some of the top business leaders of the industry as EM turns 13 with this issue. This anniversary edition Cover Story acknowledges the massive technological boom of the Indian industry and how the leaders are taking efforts to make the nation an exemplary hub & inspire young leaders to take unwavering steps in making India proud.

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Deepak Jain,

Chairman & Managing Director,
Lumax Industries

With Lumax Industries continuing to be a leading manufacturer of automotive components and systems in India, how vital has the Indian market been for business?

The Indian market is the fourth largest automotive market. Owing to the huge potential of the Indian automotive market, our focus is to maintain the leadership position in the Indian domestic market. Our global presence is significantly less owing to our partnership with Stanley Electric Co, Japan, as they are already present in other markets. The growth in the Indian market in the past decade provided impetus to our growth and the future holds well for the industry and we are confident to be able to retain our position in the future.

What would be the top three leadership suggestions that you would like to give to the next generation leaders of India?

There are stalwarts in the industry, and I am learning from them. Nevertheless, I would like to suggest the following:

The first point would be 'Customer First' and by customer, we mean everyone—all stakeholders. We have to respect everyone, listen to everyone, work for everyone, and take along everyone and then only we will achieve success. Success is not an individual phenomenon, rather a collective effort which requires people centricity.

The second point will be to focus on partnership and collaboration, nurturing relationships with all its partners, working through complex challenges in a competitive and evolving environment has helped Lumax retain its market leadership position in lighting and gear shifters.

Third point would be to have the courage to take risks. Without taking risks, nothing was ever achieved in this world. There was a lot of risk involved behind putting a man on the moon. But, humanity did it. Yes, there must be strategic thinking behind taking risks, and we should encourage that. So, that there is adequate space for innovation in the world. We should all remember; the next big thing is just another risk away.

With ever-evolving customer demands across your product portfolio, how is your R&D providing a competitive edge in the industry?

We are relentlessly upgrading our technological capabilities, with more focus on our R&D and enhancement of our products. A significant part of our budget is committed to R&D and skill development of the engineering teams to ensure a competitive edge. There is increasing focus towards electronics and LED adoption, aesthetics, light weighting and of course technological innovation to meet the regulatory norms. We continue to work on design and development to innovate and provide local solutions best suited for the evolving auto industry in India.

With two Government of India certified R&D centres, one in Gurugram and another in Pune, we cater to the needs of OEMs across the country. These teams are well supported by our Taiwan design centre, which was established six years ago, and the recently inaugurated Lumax Europe Technical Centre in the Czech Republic. Our partners, Stanley Electric Co, have been instrumental in bringing advanced technologies to the Indian market for almost four decades. Now, with the Czech centre, we are confident that there will be an amalgamation of advanced technologies from Europe, Taiwan, and Japan for the Indian market, and this will eventually be a game changer in the technology race.

With the automotive lighting market size projected to reach $66.45 billion by 2030, how do you think that the company will contribute on this front so that India goes on to become a global manufacturing hub in the coming years?

The industry is expected to move towards electric and hybrid vehicles. This will require manufacturers to equip vehicles with efficient and light weight electronic parts like LED headlamps and accessories, which spells business opportunity for Lumax Industries. Holding to a long-term target of achieving 50% in the LED segment from conventional lighting. FY22, LED segment contributed 33% of our total revenue, which is similar to last year.

The company has a healthy confirmed order book of around 1000 crores. 90% of it is in the new business, out of which 30% of the orders are from EV models. Also, approximately 60% to 70% of that order book, is in the passenger car segment.

Like I said before, we are completely focused on increasing our competencies, capacity expansions, bringing in advanced technologies from Europe, Japan and Taiwan, which will definitely help us improve our order book and satisfy the demands of our esteemed Indian customers. We have targets set for the next five years, and we are currently working towards meeting them. However, as India becomes the global manufacturing hub, we will look for opportunities to expand our operations by supplying to other markets. Thereby, contributing to and being part of India's global growth story.

We look forward to new technology such as AFL-ADB projector systems to play an important role in mobility in India. We work with customers from development stage – early engagement, focusing providing more efficient and improved products not only in the field of lighting but also in the electronic localisation.

Lumax recently opened a new technology and design centre in the Czech Republic. How will this development help in boosting the Indian automotive lighting market?

The newly inaugurated Lumax Europe Technical Centre is an advanced lighting and technical centre in the Czech Republic, making it the company's first technology centre in Europe opened under the aegis of its wholly-owned subsidiary, Lumax Industries Czech. Located in the CT Park industrial zone in Ostrava-Hrabova, Czech Republic, it was established to provide advanced technological automotive lighting solutions for the Indian market.

The centre will play a critical role in enhancing competencies in the design of optics, electronic hardware, and software for automotive lighting, which includes CAE analysis and simulation, etc. Our Czech team will be particularly focused on electronics and software development, which are clearly the main building blocks of future automotive lighting technologies. The new centre will also be involved in augmenting the company's engineering competencies in the areas of process development, the creation of custom engineering tools and software, as well as training and skill development.

"Lightweighting of vehicles is crucial in sustainable auto component manufacturing"

With a lot of focus being given to going green and developing sustainable/eco-friendly solutions. How are you strategizing your business operations on these lines?

Going green and developing sustainable solutions is the need of the hour, this ranges from procurement to manufacturing and last mile connectivity through an efficient supply chain. Consumer behaviour is increasingly moving towards an environmentally conscious perspective, and the automotive sector has to adapt with agility and efficiency.

An important trend in sustainable auto component manufacturing involves lightweighting of vehicles. Automotive lighting is EV agnostic, thus, Lumax Industries in that space is taken care of. However, we are continuously working towards making our lights more efficient, light weight, feature driven that provide impeccable safety on the road. LEDs are the future for automotive lighting.

We have been incorporating green manufacturing and sustainable working with renewable energy, water recycling, and rainwater harvesting. We monitor our carbon footprint and work towards its reduction across all our manufacturing locations.

Parakramsinh Jadeja,

Chairman & Managing Director,
Jyoti CNC Automation

There have been issues with the high cost of capital, high imports and lack of skilled manpower in the machine tool industry. How is the company strategising its business operations to eliminate these issues?

In the growth cycle of any economy, inflation and the high cost of capital are the by-products. The increased cost of capital can be counterbalanced by the enhancement of productivity and cost optimisation across the manufacturing processes. Rather than depending on the availability of skilled manpower, the industry must set up training to train the unskilled and semiskilled manpower in line with individual needs.

Our company has a robust training and development mechanism in place where we have a training set up with a pre-defined syllabus in accordance with the captive needs. Cost optimisation is another element where our team is thriving to produce goods at a minimal cost with the introduction of various productivity enhancement tools and practices.

Many companies have been focusing on going green/electric. How is the company working towards the same?

Going green is the need of the hour and Jyoti is keen on the concept. In particular, the automobile industry is on the verge of a paradigm shift from conventional to electric vehicles. We anticipate several alternate components where we do find an application for metal cutting, and we are continuously developing solutions for the same.

What would be your leadership suggestions to new-age leaders?

The new-age leaders must be agile enough to adapt to the ever-changing business circumstances. They must undergo the process of learning, unlearning, and relearning in line with the dynamics of the machine tool industry. There are lots of emerging avenues like aerospace, defence, energy, and last but not least, the electronics and telecommunication industry, where a focused approach needs to be kept.

The machine tool industry is considered to be the mother of the manufacturing industry. Hereby, the machine tool industry would act as a catalyst for the success of 'Make In India' with an enhancement of capacities, increased quality, and fast and thorough adaptation of new-age technologies to enhance productivity across the industrial spectrum.

Can you share the journey of your success story? What are the top three takeaways you would like to share about leadership?

It has been a long journey where we have undergone lots of thick and thin. As a leader, there are many takeaways about leadership. The persistence to thrive to produce quality products, customer orientation and agility to adapt the new technologies would surely pay back. Customer centricity is the most proven success factor for any business. For a leader, it is of utmost importance to produce other leaders as an ecosystem to build a long-lasting business entity.

"Producing other leaders in the ecosystem is critical"

A high level of accuracy is required for aerospace, automobile, and defence applications. How is Jyoti CNC's R&D centre contributing towards the same?

With a company like Huron Graffenstaden, France in our kitty, which is acclaimed for its proficiency in precision across the European sub-continent, we consider precision our forte. Our products are acclaimed for their consistent accuracy throughout the life span of the products.

We are keen on developing machines which can produce high accuracy through our R&D team of more than 80 R&D engineers, thriving to get the best of precision and accuracy all across our product basket. Our machines are well accepted and lauded in industries like aerospace, automobiles, and defence.

With Jyoti CNC continuing to take giant strides in machining tech in India and Europe, how do you foresee the current business outlook?

We are poised at an interesting juncture where the world is concerned about geopolitical circumstances like increased inflation across the western world; fear of recession in the near to mid-term future; gloomy picture of crude availability and prices; unending war situation in Russia-Ukraine; and so on and so forth; where we foresee India in a sweet spot.

The corporate earnings and capex cycle look promising, and so is the manufacturing sector growth. With the mission of Aatmanirbhar Bharat, India is set to become a $5 trillion economy where we anticipate 20-25% of the GDP would come from the manufacturing sector which counts to be the gig one trillion! The future looks promising with the various government initiatives like PLI schemes in various manufacturing sectors. We, as a country, would be beneficial in terms of the China plus one strategy for the world. The growth in the manufacturing sector will be reflected multi-fold in the machine tool industry.

Moving forward, how do you think the Indian machine tool industry can become globally competitive?

The Indian machine tool industry can become globally competitive for obvious reasons like the availability of manpower at a reasonable cost compared with global peers. Focused on productivity can make us competitive, and all the local machine tool players are serious about the enhancement of productivity in each of the manufacturing processes. Once the volume comes, the Indian machine tool manufacturer can be cost-competitive with the increased buying power. It may not be long before the Indian machine tool industry dominates the global machine tool industry as the western world is no more competitive due to various factors and the manufacturing base of lots of multinationals shifting from China to India.

Mathew Thomas,

Country Manager and Managing Director, India, Siemens Digital Industries Software

With a vast footprint in the digital industry software space worldwide, how eminent has the Indian market been for business, delivering future technologies?

India has always been an important part of our software business. Over the years, we have achieved considerable success in building a strong community of customers in India, and our business here continues to see healthy growth with both large enterprises and SMBs embracing our Xcelerator portfolio to enable their digital transformation efforts. But that's not all. India is also a key source of intellectual capital for us, with one of our largest product development centres located here.

Companies today are under increasing pressure to follow sustainable practises that come at a cost and impact profitability, what are your views on the Smart Manufacturing Revolution and how do you think your R&D contributes to this?

Sustainability is the heart of our business and the engine that drives it. This is why we've developed a sustainability framework called DEGREE (Decarbonisation, Ethics, Governance, Resource Efficiency, Equity, and Employability), which sets clear and measurable ambitions. We issue an annual sustainability report outlining our progress toward stated goals. The same philosophy extends to the solutions that we provide to our customers that can help them improve their quality of life for their customers while using fewer resources. Smart manufacturing will play a key role in this initiative. By leveraging executable digital twins across their product lifecycle, manufacturers can achieve their sustainability goals without compromising on either quality or profitability, finding the right balance and a wide understanding across the entire value chain from the very beginning, providing an accurate picture of its total environmental impact, including that of suppliers, distributors, and logistics operations.

What are the significant developments the company has made when it comes to digitalisation? Can you share some recent success stories regarding how it has been vital for the industry to adopt it?

Our Xcelerator portfolio ignites digital transformation, empowering companies of all sizes to embrace complexity and leverage it to enhance productivity and gain a competitive advantage. One of our customers in India, a leading automotive OEM, recently published a success story that showed how they were able to increase throughput in their paint shop by 15% by implementing our IoT solution. Another customer, a small tool manufacturer, achieved a 50% reduction in product development time by implementing a product development system, while a line builder was able to reduce commissioning time on average by 70% through a virtual commissioning environment.

What are the three takeaways you would like to share with Indian leaders as they adopt digitalisation and automation to help accelerate the industrial digital transformation?

Firstly, digital transformation is a multi-year journey, not a short-term fix. It needs to be driven from the top of the organisation. Secondly, it is important for leaders to build an overall digital transformation strategy before getting into implementation. We have a framework of digital threads by an industry that can help guide and inform leaders as they build out a digital transformation roadmap in line with their strategic priorities. Thirdly, it is important to work with a trusted technology partner that can provide powerful tools that enable the creation of a comprehensive digital twin, while providing a flexible, adaptable, and open system. Given the growing maturity of cloud-based software deployments and the flexibility that this creates for companies, leaders should seriously consider cloud deployment.

"India is uniquely positioned to be a key player in this digital future"

India is evolving as a global manufacturing hub wherein industrial software has played a crucial role. How do you look at it, and how is the company strategizing to embrace complexity and leverage it to enhance productivity and gain a competitive advantage?

The industrial world is in the midst of transformation, and so is India. It is adapting fast to this change. Today's products are becoming smarter, and more personalised. New insights, new opportunities, and new levels of automation at every point of the value chain. These aren't the promises of tomorrow, they're the opportunities of today. Siemens Digital Industries Software brings the latest in the world to India, blurring boundaries between industry domains by integrating the virtual and physical, hardware and software, design, and manufacturing worlds while being personal and highly adaptable, which organisations need. With an open, modern, and flexible ecosystem, organisations can predict and adapt to future needs, giving them the ability to meet rapidly changing consumer preferences and hence gain an advantage in the globally competitive landscape.

What is the piece of advice you would want to give to the new-age industry leaders in India?

Today's products continue to grow in complexity, requiring the integration of multiple domains, including mechanical, electrical, electronic, and software design. This trend is set to continue as demands for integrated AI and vision systems, machine connectivity, and remote monitoring increase. Considering the simultaneous pressure to shorten delivery times, manufacturers face a huge challenge.

To address this challenge, the most progressive companies are increasing their adoption of digital technology to accelerate innovation and optimise existing products. The recently produced 2022 Digital Twin Study by Lifecycle Insights found that the most progressive companies will continue to invest in technology, increasing the gap with those who lag, leaving them subject to a harder competitive outlook and potential losses in time to market, and ultimately lost business.

Could you share your thoughts on what lies ahead for industrial software and how it will play a critical role in assisting India in establishing a global footprint in the digital ecosystem?

The digital future of the industry is no longer some far-flung promise but is here today. India is uniquely positioned to be a key player in this digital future, given our young and technologically savvy workforce. However, long-term success requires a strong collaboration between key stakeholders like the government, industry, and academia to create a stable policy environment, encourage entrepreneurship and innovation, and provide skill enhancement opportunities to young Indians.

Also, manufacturers that embrace advanced technologies are able to be more agile and resilient and are more successful in managing complexity, changes, and disruption.

Vijay Kalra,

Head - Mahindra Institute of Quality,
Member - Group Corporate Office Leadership Team,
Ex ED & CEO MVML and Chief of Mfg Operations AD, M&M

How has the Total Quality Management (TQM) process shaped the entire business value chain of the Mahindra group to meet global standards?

Mahindra has a core value of customer centricity and promotes TQM through The Mahindra Way (TMW), an integrated approach for world-class standards through the application of robust systems and processes, as benchmarked with other global excellence models like Deming, Malcolm Baldrige & EFQM. In addition, it includes a set of Group Common Policies and Practices (GCPPs) hence promoting 'One-Mahindra' ethos. TMW encourages benchmarking with the best in the world and continuous improvement by the involvement of all employees.

This has helped the organisation to focus on improving process orientation, by adopting a structured approach to Management and Business Processes framework, thereby enhancing its capability to achieve improved results. The framework includes an assessment of the four management processes namely, Top Management & Leadership Strategy (TMLS), Daily Work Management & Standardisation (DWMS), Quality Management & Quality Improvement (QMQI), Employee Involvement & Development (EID), along with critical business processes.

With the advancement of technology, what are the steps the industry needs to take to fill in the talent pool gap in India?

The Indian industry has created a decent talent pool that produces world-class products and services for domestic and export markets. But as manufacturing is poised for a high growth period, there will be a shortage of talent, especially in emerging technologies. Due to this, the industry will need to develop talent by increasing its training and development efforts, especially in emerging technologies and operational excellence. M&M has set up the Mahindra Institute of Quality to develop world-class competencies in operational excellence, quality management and emerging technologies.

Fresh engineers need to be continuously trained and groomed in traditional methodologies like lean/TQM and new emerging technologies like IoT and analytics to build a high-quality/performance culture. Training the workforce in these skills and handholding is the key for it to become a way of life, rather than treating it as a one-time solution being implemented by specialists.

How is IoT making the manufacturing & distribution businesses more efficient and adaptable? How should one strategise the business operations on these lines?

IoT is providing an integrated unified environment, that gives the agility to react quickly to change, and makes intelligent/nuanced decisions, thereby making manufacturing and distribution businesses more efficient and adaptable. For example, smart metering, a smart network of robots on the manufacturing floor, or a group of tractors planting a field, each with their onboard computer and array of sensors. Good value creation comes when IoT devices generate real-time data, shift through streams of device data, identify events and patterns, find actionable insights, and then orchestrate the actions across the enterprise that are required to achieve the desired outcomes.

With increasing complexities in the supply chain, IoT platforms have now become essential for all businesses. I believe a good way for the potential of IoT to be harnessed is by first identifying the key operational outcomes relevant to the business, and then building an integrated system that orchestrates, automates, and manages all the business processes and resources required to achieve these. Also, involving front-line managers in the design and implementation of IoT solutions right from start is a crucial step in the digital transformation journey.

"Get comfortable with ambiguity and chaos"

What does operational excellence mean to you and how do you define its competitive edge in the industry?

Operational excellence is a journey to attain and sustain competitiveness. We need to continuously improve the way we do business to remain relevant in the changing world. Our business models, products, processes, and systems need improvisation continuously for delivering value to all the stakeholders. A few years back Lean, TPM and TQM were the enablers for delivering a competitive edge. Now with the advent of Industry 4.0, the overall potential has increased multifold. Lean 4.0 is the answer in the manufacturing industry for today's hyper-competitive world.

In the future, the competitive edge of operational excellence is going beyond words like productivity, efficiency, and standardisation to concepts like growth, innovation, and customisation.

In my view, with increasing competition and products and services becoming more & more uniform, operational excellence will emerge more strongly as a key differentiator and good operational managers will be in high demand. For sectors like aviation and real estate & logistics, differentiation through operational excellence is the primary means of enhancing competitive advantage.

What are your views on the new emerging technologies when it comes to Industry 4.0 and how is the current workforce adapting when Industry 5.0 is knocking on the doors?

Industry 4.0 is revolutionising the way companies manufacture and distribute their products. Technology levers like IoT, Big Data, AI, automations, AR, VR, digital twins, etc are enabling manufacturing to go to the next level in all areas. In my experience, the adaptation has been good at most OEMs, whereas many tier 1 and tier 2 companies have just started on the journey recently.

Industry 5.0 is still in its infancy and manufacturers need to ready their workforce to better integrate machines & humans, working together with higher cooperation between machines and humans (like cobots), and bringing a more human touch to operations, for benefits like human-centric designs, higher customisation/personalisation for customers and sustainability.

How vital is the upgradation of skills of the current industrial workforce given the ever-changing market dynamics?

Some examples of changing managerial roles and skills, due to market dynamics are:

- **Flexibility and creative thinking:** Managers of the future won't be defined by a single methodology or approach. Instead, they will be looking outwards at different methodologies, approaches, and technologies to identify those that will make the biggest impact within the business context.
- **Understanding and adopting new technology:** Managers will need to increase their understanding of automation, robotics, digital systems architecture, etc.
- **Data analytics/visualisation:** Managers will need to play a role in identifying the required data and understanding how to render that data in a format that is simple and easy to use for the business user to act on it.
- **Designing better experiences:** Operational excellence professionals will need to be able to design better processes for a good experience for customers and employees.

What would be the top three leadership suggestions that you would like to give to the next-generation leaders of India?

1. **Big picture thinking:** Most successful leaders will engage in big picture thinking that synthesises numerous perspectives from throughout the organisation. They will have an aptitude for looking at a problem from all vintage points and figuring out the best possible solution informed by multiple perspectives. Business leaders must get comfortable with ambiguity and chaos.
2. **Ingenuity:** A propensity for developing innovative new ideas and taking strategic risks. Successful leaders will have a propensity for problem-solving because they dare to take risks and the creativity to come up with ingenious solutions that no one else has thought of.
3. **Collaborative, fast, agile and bold:** Ability to work collaboratively to align the entire organisation towards a common purpose/goal for taking bold bets to get the best out of people while being fast and agile to adjust to changing environments. The ability to relate to people on a personal level, build trust and rapport, and get results through the ability to motivate and inspire them can be a big differentiator.

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Kishore Jayaraman, OBE,

President - India & South Asia, Rolls-Royce

With India set to become a global aerospace hub, how important is Rolls-Royce's partnership with the Indian aerospace industry in the context of Make in India and Aatmanirbhar Bharat?

Rolls-Royce's nine-decade-long partnership with India is built on successful collaborations with the Indian aerospace and defence industries. Rolls-Royce engines powered the first civil aircraft of Tata Aviation in 1932 and the first military aircraft of Indian Air Force Squadron Number One in 1933. Ours is the original Make in India story, which started over 70 years ago with Rolls-Royce partnering with Hindustan Aeronautics (HAL) for whole engine technology transfer, whereby Rolls-Royce engines have been manufactured in India. We continue to build on this relationship to deliver service excellence and supply chain capabilities. We have a dedicated service delivery centre in Bengaluru that supports all the engines in service with the forces. We are also working with HAL to set up an authorised maintenance centre for our Adour engines and to Make In India Adour Mk871 parts to serve our international military customers. These partnerships are strengthening the company's regional service footprint and helping India emerge as a global hub for defence sourcing, assembly, and MRO services.

We are also particularly proud of the success of our joint venture with HAL called International Aerospace Manufacturing (IAMPL). In just 10 years, IAMPL has grown to become a top-tier supplier in the the company global supply chain, manufacturing more than 160 high-precision components for the Trent family of civil engines. Our other joint venture with Force Motors, called Force MTU Power Systems, manufactures the MTU brand of series 1600 engines and generator sets for both Indian and global markets. We believe the future will be all about 'Creating in India' in collaboration with willing global players, with India co-owning the Intellectual Property (IP) in areas of strategic importance. Rolls-Royce is well positioned as a natural partner in India's growth and Aatmanirbhar Bharat journey.

Going forward, what is your company's commitment to the Indian market?

Rolls-Royce has been investing in creating capabilities in-country and forging partnerships with the domestic industry to help further the goal of self-reliance. As India's indigenisation journey gains momentum, Rolls-Royce remains committed to partnering with India's progress through co-development, co-creation, and co-manufacturing opportunities.

How do you think the Indian industry can bridge the existing defence capability gap? What kind of technological & manufacturing capacities are required for this?

The Indian defence industry has a key role to play in realising the Prime Minister's vision of an Aatmanirbhar Bharat. Through various initiatives, the Government of India has showcased its intent to bolster the defence ecosystem in the country, and the industry has responded with significant investments and expansion plans. This growing ecosystem capacity will be well-utilised when defence technologies will be created and owned in India to be manufactured locally. The defence ecosystem will undoubtedly rise to meet the supply chain and manufacturing opportunities, and this will further create capabilities across the value chain.

With capability and capacity creation across design and development, supply chain, manufacturing, and aftermarket services, such a programme will increase India's competitiveness in the global arena. When technology is developed in India and the know-why rests within the country with IP owned by India, there is a great opportunity to leapfrog the country's status as a technology supplier to the global market.

Industry 4.0 also has the potential to transform the aerospace and defence sectors. To gain momentum and raise its competitiveness in manufacturing, the adoption of new technologies will prove to be an enabler for the Indian industry. In addition, we must focus on upskilling our talent to meet the challenges of the future.

"The future will be all about 'Creating in India' in collaboration with willing global players"

Rolls-Royce has a history of working across domains in India. How important has the Indian market been for your business?

We have a strong presence in India across all businesses—defence, civil aerospace, and power systems, and have been committed to expanding our footprint in the region. Over the years, we have built a strong ecosystem of Indian partners, talent, supply chain, digital, service delivery, and manufacturing capabilities.

We have a rich legacy of partnering with the Indian Armed Forces; today, more than 750 Rolls-Royce engines of 10 types are powering Indian military aircraft. Our MTU engines power several Indian Coast Guard and Indian Navy vessels, with a service team present at several locations along the coastline. Our dedicated Defence Service Delivery Centre in Bengaluru provides end-to-end solutions for all Rolls-Royce aero engines in service with the Indian Armed Forces.

Over the past few decades, we have also built a robust supply chain and a strong pool of engineering talent in India to support the global fleet of Rolls-Royce aero-engines. A dedicated engineering centre in Pune also supports global research and development programmes for our power systems business. A team of digital engineers at R2 Data Labs in Bengaluru collaborates with global teams to generate data-led insights and solutions.

We believe India holds great promise and offers multiple opportunities for all our businesses, and we believe that we are well-positioned to meet the demands of and create opportunities, in this market.

In the context of growing environment awareness, what measures has Rolls-Royce taken to ensure cleaner and safer engines, both in the aero and marine sectors?

At Rolls-Royce, we are committed to the UN net zero goal of making all our products and operations net zero by 2050. All our new products and facilities will be compatible with net zero operations by 2030. Over 50% of our R&D budgets are currently allocated towards low and net zero technologies, and we plan to increase this spending to 75% by 2025.

Electrification has the potential to transform the future, and as a world-class provider of electrical power and propulsion systems, we are championing electrification in both the aerospace and marine sectors. Our all-electric plane, 'Spirit of Innovation' has achieved the world speed record to become the fastest all-electric plane, and this was supported by data analytics provided by our digital team at R2 Data Labs in India. Indeed, digital technologies will also play a critical role in shaping the future by solving complex challenges. Rolls-Royce data experts analyse data from millions of flights every year. Our analysis helps save our customers 100,000 tonnes of fuel per year—that's enough fuel for a 747 to fly to the moon and back, 13 times. We believe that pioneering innovative solutions like this not only mark a new and exciting era in electric aviation, but also heralds the future of flying sustainably.

Our experience supporting the electrification of the Royal Navy's warships over many years makes us well-placed to support the Indian Navy for its 'fleet of the future'. In addition to its technologically superior offerings and full-electric propulsion solutions, Rolls-Royce is the only provider of marine gas turbines for integrated full-electric propulsion (IFEP)-powered destroyers and aircraft carriers.

Alternative fuels are the future and can help make today's technology compatible with net zero. At Rolls-Royce, we are already testing our engines with Sustainable Aviation Fuels (SAF), and we are committed to ensuring that all our aerospace engines are compatible with 100% SAF by 2023. We are also working on hydrogen fuels, and have launched trials of liquid hydrogen combustion at power plants. While the majority of our products can run on synthetically derived low-carbon fuels, the industry is facing demand shortages due to the high costs associated with manufacturing such fuels. Rolls-Royce has been working with industry partners to advocate for and accelerate the availability of alternative fuels. There is no single technology to reach zero emissions. Our focus is on what it will take to make carbon-intensive parts of our economy, such as aviation and power generation, compatible with net zero and commercially viable, while also pursuing some exciting new breakthrough possibilities.

In the midst of such a dynamic Indian market landscape, what would be the top three leadership suggestions that you would recommend to the next generation of Indian leaders today?

Change is the new normal for all leaders today and tomorrow. I believe there are three factors that will be key to success for all leaders - technology, adaptability, and people. The future of businesses will be defined by enhanced data and connectivity, manufacturing innovations, digital disruptions, and more. Therefore, it is crucial for leaders to invest in technology, irrespective of the sector in which they operate, especially in manufacturing.

As we have seen in these last few years, change is the only constant, so adaptability is critical to building business resilience. Adaptability will help leaders assess and tap signals of change quickly, implement short-term and long-term operational changes, and access opportunities faster. As Charles Darwin said, "It is not the strongest of the species that survives, nor is it the most intelligent; it is the one that is most adaptable to change." People are the indispensable backbone of any business. While being tech-enabled is essential and adaptability is the need of the hour, it is people who will drive change and help lead an organisation to success. As leaders, we must create a future workforce that feels empowered with technology and is bold and agile in the face of change.

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YOUR GLOBAL CRAFTSMAN STUDIO

Maarten Durville,

Managing Director,
GKN Fokker Elmo India

With a strong presence of leading aerospace companies and two manufacturing facilities across India, how important has the Indian market been for your business?

The Indian market is expanding rapidly. The decision to choose India as a manufacturing location was strongly influenced by the rising importance of the Indian market. The number of passengers and flights is increasing. Also, Indian carriers are expanding, as is the manufacturing infrastructure.

The Pune plant has set an excellent example of gender diversity. Can you share some recent success stories involving them?

The energy and strength of our female workforce are amazing. They absorb knowledge quickly and are always eager to learn. My proud moments are when auditors from institutions or customers come by and go to the production line. Without any guidance, young women can explain the most complex tasks and relate how they conform to quality standards.

Since the inauguration and start of production, we have grown quickly. Quite a few women have already moved into more senior positions such as Manufacturing Engineer or Process Specialist. The process specialist not only has to know the product and process inside and out, but she also has to understand lean manufacturing principles. Candidates for these positions were asked to present their ideas for production, and we were blown away by the quality and understanding. It will not be long before they will further move into management positions.

With India progressing rapidly in aircraft manufacturing, how are you strategising your business operations?

GKN Aerospace now has a growing engineering unit in Bengaluru and a fast-growing factory in Pune. Important elements of our strategy are to follow customers and capitalise on the strengths and characteristics of the location. In that respect, there will be ample growth in the future to increase the size of operations and the maturity of the tasks that the units perform.

The global aircraft wire & cable market is projected to reach around $1.15 billion by 2028. How is the company's R&D unit working to provide a competitive edge in the industry?

Apart from the existing market segments, some exciting new segments are appearing in the market. Electrical planes in the urban air mobility segment are being developed by numerous companies. For the mid-range, hydrogen, often in combination with an electric engine, is a sought-after solution. The requirements for such high-power electricity transport require new wiring solutions. GKN Aerospace aims to be the most trusted and sustainable partner in the sky. Therefore, these developments are right up our alley and play to our strengths as a one-stop shop for wiring harness design and manufacturing.

"Critical thinking is key"

When it comes to business development in India, what are the company's plans for expanding? What would be the top leadership suggestions you would like to give to the young Indian leaders of today?

After the inauguration in 2019, we have doubled our employee size each year. At the moment, we are adding about 25 new people per month and are about 400 people strong. Our output will double in 2 years and in 4 years again. GKN Aerospace invests about $10 million in the site in hardware. Even more significant is the investment in training and development. We have set up a dedicated aerospace training centre with independently certified trainers. All new employees are trained to become certified aerospace specialists, a process that takes several months.

A special characteristic of our company is that more than 90% of the workforce is female. The women are typically young, have little or no experience and are coming from all over Maharashtra. The choice for a predominantly female workforce comes on the one hand from the fit between their strengths and the traits of our production, and it also fits our desire to improve the position of women. And recently we started to employ women with a physical challenge who are typically even more disadvantaged wrt the labour market. They are doing a great job and fit right in. The first product we shipped was a wire harness for Collins Aerospace which is part of the air management system of the Boeing 787 Dreamliner. In the meantime, we are producing for Airbus and Boeing as well. So if your light switches on properly when you travel in a Boeing 737 or you see the wing lights in the Airbus 320, we took care of that.

The expansion to Asia is an important part of GKN Aerospace's long-term growth strategy and global operating model. The aerospace market is a global market, we compete with sites all over the world and export 100% of our production. When our sister factory in China was running out of space we did not just move it to a bigger site. Instead, alternative locations for expansion were investigated. Locations in North America, Europa, Africa and Asia were reviewed and ranked. The availability of workforce, abundance of talent, and growing aerospace footprint were all important factors to choose India over other options,

In the global picture, the importance of Indian aerospace ecosystem is rising. The airline companies from India are growing rapidly again after the pandemic. They continue to do so in the future, as the number of people who can afford air travel is on the rise as is the Indian economy. The pandemic will be just a blip in the overall long term upsurge. As a result, the market becomes more interesting for all market big players be it the likes of Airbus and Boeing or be it for the smaller players. With the

growth of the Aerospace manufacturing ecosystem, in the future we can also add Indian suppliers to our supplier base.

Looking back, the decision to choose India as the location was the right one, and we just got started.

How is the production of electrical wiring interconnection systems contributing to making India a global manufacturing hub?

With most commercial planes being made in the US and Europe, most of the wiring harnesses produced are exported. Our factory in Pune is exporting 100% of its production. Producing wiring harnesses is a people-intensive business. A lot of people are trained in aerospace manufacturing, with all its special high-end requirements. With the growing pool of people that know the ins and outs of aerospace manufacturing, the Indian market will become even more attractive.

What would be the top leadership suggestions you would like to give the young Indian leaders of today?

Looking at young potential leaders, I often see a drive for a slightly fancier title and a quick salary increase driving career decisions instead of mastering a field of interest and accomplishing results in it. Looking back at your career, one will notice that it is not the speed of progression in the first years that makes the difference. It is about getting really good at what you do.

Also, critical thinking makes a difference in multinational corporations. Do not try to guess what your manager would like you to come up with. Rather, come up with a proposal after performing a good data-driven analysis and doing a sanity check. Always ensure that you can answer the questions you can expect from your manager.

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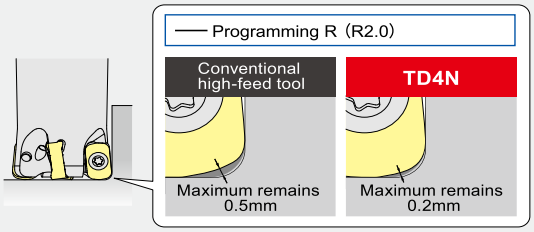
TD4N

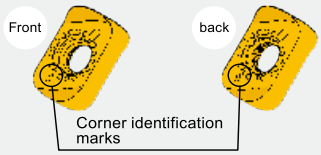
Radius mill TD4N

Reduces uncut remnants on work pieces

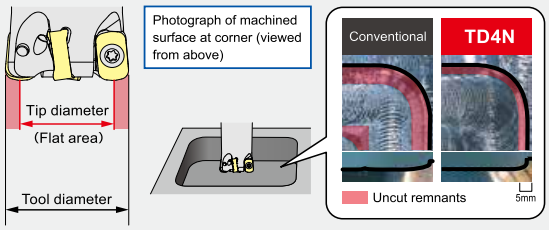
The cutting edge shape was reviewed for TD4N so that uncut remnants are reduced. This enables the load on the next process to be reduced by up to 40 compared to conventional products.



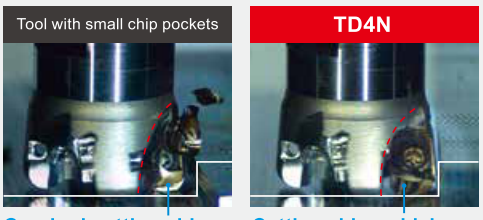
Economical 4–corner inserts with chip breakers for various applications



Large tip diameter for excellent handling

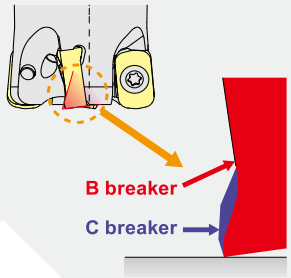


Excellent chip discharge characteristics

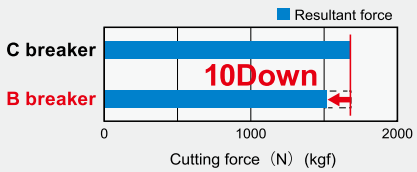


Magnified view of cutting edge cross section

Positive rake angle



Comparison of cutting force



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Dr Pramod Chaudhari,

Founder and Executive Chairman, Praj Industries

To begin, congratulations on receiving the George Washington Carver and William C Holmberg Awards, which are regarded as the top global honours in bioeconomy. For benefit of our readers, can you please tell us more about these achievements?

Thank you. Yes, it is very fulfilling experience to bring these awards to India for the first time. In an industry dominated by developed economies, these awards are a testament to India's growing prowess in the bioeconomy globally. I dedicate these awards to all my fellow colleagues at Praj who have been working relentlessly to realise our vision of making the world a better place by deploying technology-embedded sustainable solutions.

George Washington Carver's pathbreaking work in technology innovation in the 20th century has revolutionised agriculture and the environment. Institutionalised in his memory, this award recognises exemplary contributions by individuals in industrial biotechnology. Lt Col William C Holmberg, on the other hand, did pioneering work in bioeconomy and is widely regarded as the architect of the United States' renewable fuels programme. This award is presented to distinguished individuals around the world for their trailblazing contribution to the bioeconomy.

Looking at the future, in the midst of VUCA environment, growth needs to be balanced with sustainability. What would be your advice to new-age industry leaders who want to be globally successful?

VUCA environment is the new normal. The global economy is on a weak wicket, thanks to geopolitical upheavals and calamities attributable to climate change. Surviving and growing in this unprecedented environment is challenging, as there is no playbook to refer to. However, as an eternal optimist, I do believe that every challenge brings an opportunity. I think leveraging digital technology by integrating it in every possible way into products and solutions to create customer value, is the way forward. At IEEE global annual conference, I put forth the concept of an Industry 5.0 enhanced version with a due focus on the environment and people, that was positively received by stakeholders. This concept harnesses cobots and the bioeconomy to strike a fine balance between people, the planet, and profit, which were compromised in the earlier industrial revolutions. I also strongly believe in the power of collaboration; forging a win-win alliance in complementary areas is critical to global success. Although newer business models and delivery models are evolving, deep-rooted customer relationships continue to be the bedrock of business sustainability. I am convinced that organisations with an unwavering focus on ESG matters will have a distinct advantage in being long-term winner. Notwithstanding massive disruptions in the technology space, people will continue to be the most prized assets of any organisation.

"Bigger the challenge, larger the opportunity"

We understand, unlike established sectors, Bioeconomy is sun rise industry. What then are major market-related challenges? Would you like to share a case study about your technology leaving a positive impact on your customers' business performance?

Yes, that's correct. Unlike 100-year-old automobile or aviation industry, bioeconomy is still ushering in many ways. While there continues to be growing awareness about how bioeconomy positively impacts people's planet and profit, a lot of work still needs to be done for the mainstreaming of the bioeconomy. This involves creating mass awareness about sustainable aspects of the solutions, resilient ecosystem development, the availability of qualified talent, and conducive policies that create long-term opportunities to attract investments.

Before I get to the case study part of it, let me give you a context for the biofuel landscape in India. India's biofuels movement has now picked up momentum and has crossed the milestone of 10% ethanol blending in petrol five months ahead of schedule. With a favourable policy environment, India's EBP20 programme is on course, and in fact, the era of flex-fuel vehicles is on the horizon. Flex fuel vehicles are capable of operating on petrol and any blend of ethanol up to 83%. So there exists an unprecedented opportunity for ethanol producers.

However, there are constraints on the production of ethanol using sugary feedstock due to the seasonality of the sugar crop. Sugarcane crop is available for 7-8 months in India. Sugarcane juice, being perishable by nature, cannot be stored for more than 24 hours. Hence, ethanol plants cannot function beyond the sugar season, posing a limitation on year-round ethanol production and supply.

At Praj we always endeavour to devise a solution that addresses the customer's problems. A deeper understanding of customer's stated and unstated needs has helped Praj maintain its edge and market leadership position.

Scientists at Praj Matrix formulated a technology solution to address the problem statement to help ethanol plants function throughout the year. Praj has developed BIOSYRUP® using the Eco-Invert technology to convert sugar into syrup, which can be stored for a period of 12 months. This allows round the year ethanol production and increases overall productivity. By diverting excess sugar to produce biosyrup, sugar mills can operate beyond sugar season that will result in revenue maximization. Pune-based Vasantdada Sugar Institute (VSI), one of the premier R&D organisations in the sugar and allied industry has approved Praj's BIOSYRUP® for showcasing promising results in terms of no sugar loss and no contamination with an increased shelf life. Praj's revolutionary BIOSYRUP® feedstock is truly proving to be a game changer by outwitting the challenges of perishability and year-round availability of sugarcane. This technology was successfully implemented at one of our key customers' plants in Maharashtra. Now the customer can sweat his assets more and reap the dividends of better financial performance.

As a first-generation techno entrepreneur, you are a strong proponent of innovation as a business growth driver. For the benefit of other industry leaders, can you share insights on leveraging technology for business sustainability?

I have a strong conviction that technology has the prowess to change the world for the better and it is vital for business growth. We set up Praj Matrix – an R&D centre way back in 1989, in the early stages of Praj's journey. It is a state-of-the-art facility certified by the Government of India's Department of Scientific and Industrial Research (DSIR). It has five centres of excellence housed in 16 laboratories with over 90+ research scientists. The centre has more than 300 national and international patents to its credit.

Praj Matrix supports Praj's existing businesses to improve their offerings by maximising yields while minimising carbon and energy footprints. It also conducts research in the emerging areas of industrial biotechnology, including biofuels for air and marine transport, advanced biochemicals, and renewable materials. Praj has developed several innovative technologies that have won accolades globally. Praj is now a trusted global partner for customers, with over 1000 references in over 100 countries across five continents.

As for the insights, I urge business leaders to harness technological advancements so as to ensure long-term business sustainability. I believe all future innovations will be the culmination of cross-functional research across disciplines. So leaders must commit resources and investments in building infrastructure and subject matter expertise.

I believe all research work should be application oriented with customers at the core. It is critical to identify the stated as well as unstated needs of the customers while developing new technologies. While developing new technologies, it is important to ring-fence your intellectual property. It helps companies protect technology innovations & gain a competitive advantage. Commercialisation of technology innovations is another aspect of business sustainability. Companies need to map their technology development process through Technology Readiness Level (TRL) and Commercial Readiness Level (CRL).

To conserve the environment, government has banned single-use plastic in a bid to control its menace. We understand Praj is developing sustainable solutions by way of alternatives. Please share with us the opportunities in this space.

That is right, the uncontrolled use of plastic is severely damaging the environment and biodiversity. All of us are aware of the ill effects of plastic on marine life and how it is disturbing the ecology. According to the UN Environment Programme (UNEP) report presented at the COP 26 Glasgow summit, plastic accounts for 85% of all marine litter and will triple by 2040. India produces around 3.5 million tonnes of plastic waste annually, and the per capita plastic waste generation has almost doubled over the last five years. It's high time that non-degradable plastic, which is the source of toxic waste, is eliminated. The Indian government has taken a positive step by imposing a ban on single-use plastics beginning July 1, 2022.

In line with the government's plan to promote the use of sustainable materials, Praj's R&D team is developing the technology for the production of biodegradable plastic. These are derived by processing biobased resources, unlike the plastic that comes from the petrochemical route, which has a carbon cycle that runs for centuries.

As part of our sustainable solutions, Praj has developed the Bio-Prism™ portfolio of technology for the production of renewable chemicals and materials (RCM). RCMs are environment-friendly, less toxic, and poisonous in nature, unlike traditional chemicals and materials derived from fossil resources. RCMs have a shorter carbon cycle as they are based on the circular bioeconomy concept. The bioeconomy, in simple terms, is a knowledge economy that uses renewable natural bio-based resources to produce food, energy, products, and services. We believe, biodegradable plastics as part of our Bio-Prism™ portfolio have great potential and are emerging as a sustainable solution to eliminate the plastic hazard. We are collaborating with partners around the world to commercialise this solution, which will positively impact the environment in near future. It may be noted that in addition to having a sustainable substitute for plastic, it is very important to create awareness among the masses about adopting a sustainable lifestyle, besides the stringent enforcement of the legislation.

CYLINDRICAL GRINDING WITH SPEED

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You are a biofuels technology pioneer and market leader in India. Please tell us how biofuels contribute towards sustainable climate actions? On this front, what are the current developments and future plans at Praj?

Energy is the driving force for the industrial and economic growth of any nation. Fossil resources continue to dominate the global energy landscape. The transportation sector is the second largest consumer of fossil fuels after industry. It is also the second largest emitter of GHG that contribute to climate change. Global warming owing to CO_2 emissions is causing temperatures to rise, resulting in an increase in sea level, extreme weather, loss of biodiversity, species extinctions, food scarcity, and worsening health for millions of people worldwide. The decarbonisation of the transportation sector is not a matter of choice but an imperative as part of climate action. During the COP26 Glasgow summit, India announced carbon neutrality by 2070, as well as the Panchamrit Agenda—a Race to Zero road map. Biofuels are low-carbon renewable transportation fuels derived by processing biobased feedstock, and are poised to play a bigger part in this.

Praj's Bio-Mobility™ platform offers innovative technology solutions to produce low-carbon transportation fuels across all modes of transportation, viz, for surface, air, and marine. Bio-Mobility™ platform facilitates sustainable decarbonisation in the transportation sector. For over a decade now, Praj's market share in overall ethanol production capacity in India is in excess of 60%, which has played a big role to help India achieve the ethanol blending target of 10%. Praj has developed and successfully deployed technology capable of processing multi-feedstock to produce biofuels both in liquid and gaseous form, as well as value-added co-products. We are also commissioning the first of its kind, Asia's first 2G Ethanol Bio-Refinery that can produce ethanol using agricultural waste as feedstock.

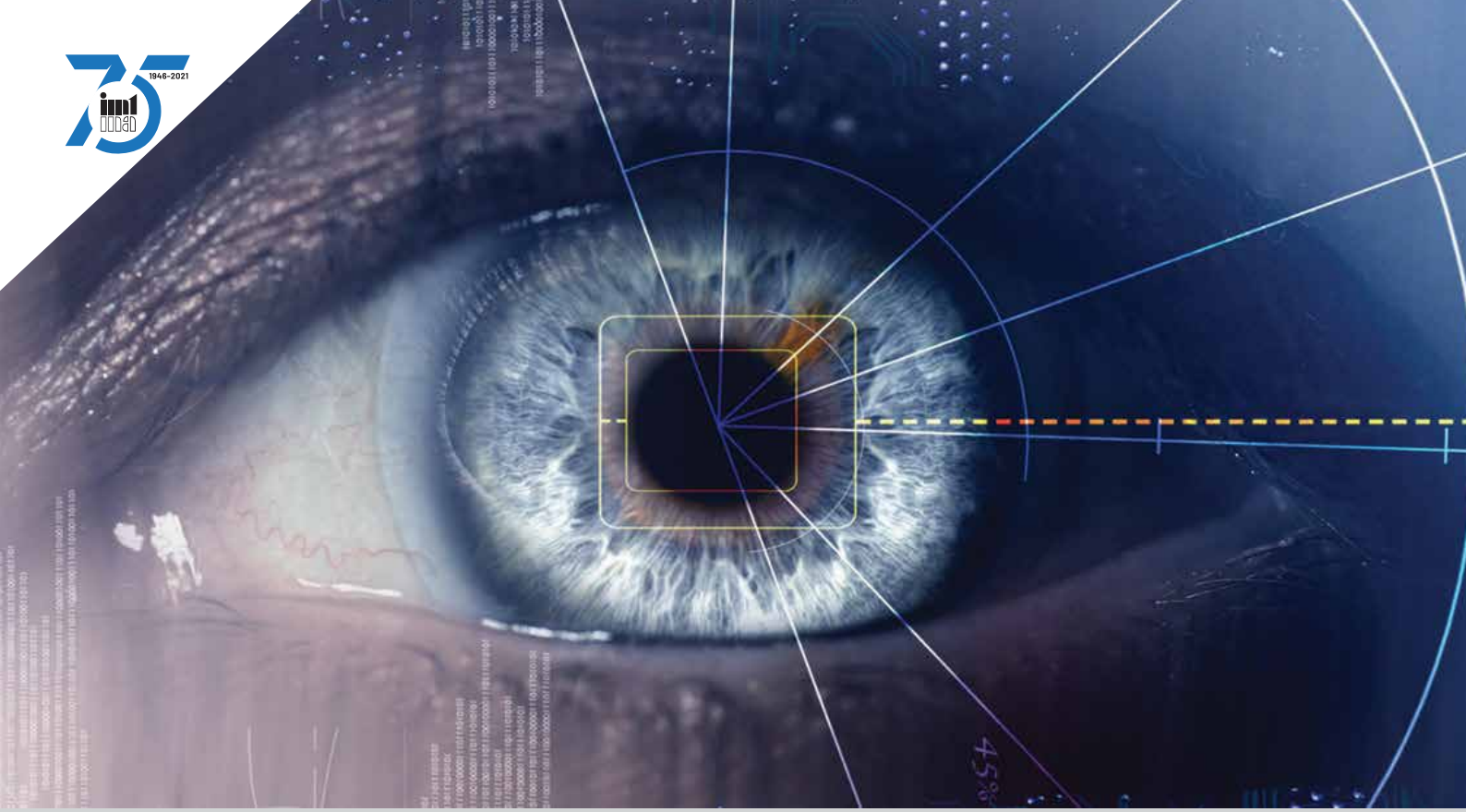
To help decarbonise the aviation sector, regarded as one of the largest contributors to GHG emissions, Praj is commercialising technology for the production of sustainable aviation fuels. Work is also underway on next-generation low-carbon biofuels, namely bio marine fuel, and green hydrogen among others.

We are aware that you also specialise in providing zero liquid discharge systems for the process industry. Can you throw some light on what ZLD is and why it is important?

Water is a precious resource that we tend to take for granted. However, research-backed reality is that groundwater tables worldwide are depleting. Heavy industrialisation, burst in housing, and infrastructure creation at the expense of forests are resulting in water scarcity. Climate change-induced droughts and heat waves are further hurting water reservoirs. On the other hand, there is mindless and uncontrolled consumption of water by the largest stakeholder—industries. Unless we harness technologies to judiciously use water, the situation will get from worse to worst.

Among the UN's 17 Sustainable Development Goals (SDG), SDG #7 specifically addresses access to clean water and sanitation. To help fulfill this, regulations are being introduced around the world for water usage and, importantly, the treatment of industrial effluents. The Indian government has now enacted very stringent regulations that make it mandatory to treat effluent and process waste for the recycling and reuse of water.

We offer a comprehensive range of solutions for industrial effluent treatment, recycling, and zero liquid discharge (ZLD) systems to customers across several sectors, namely metals, power, specialty chemicals, fertilisers, refinery & petrochemicals, F&B, etc. These solutions are based on the principle of the 3Rs – Reduce, Recycle, and Reuse, to practise zero waste and zero discharge. These not only help industries to comply with regulations but also minimise their freshwater requirements. Our ZLD solutions help our customers minimise their overall water footprint and comply with ESG objectives.



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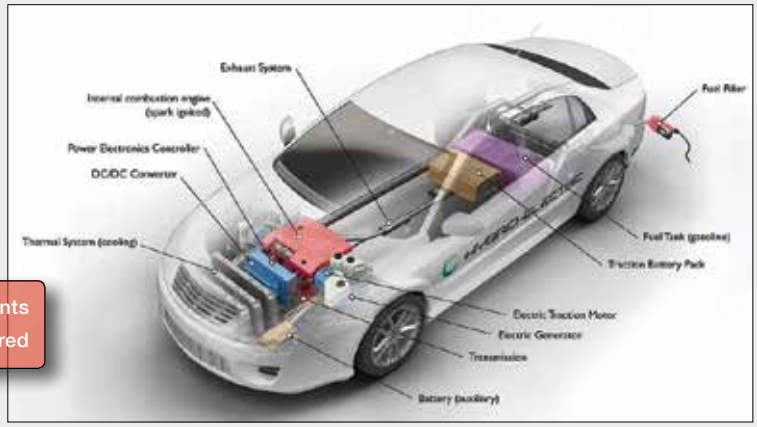
Auto components: Booming the Indian market

With increasing turnover with each passing year, the Indian auto component industry is on its way to becoming a leading global automotive manufacturing hub. The article throws light on how the auto component market is playing a vital role and will have a promising future when it comes to the Indian market.

Kamal Goyal,
Technical Advisor,
Rimaco Group of Industries

In recent years, India has become the fastest-growing economy in the world. This fast growth, coupled with rising incomes, boost in infrastructure spending and increased manufacturing incentives, has accelerated the automobile industry. Significant demand for automobiles also led to the emergence of more original equipment and auto component manufacturers. As a result, India developed expertise in automobiles and auto components, which helped boost international demand for Indian automobiles & auto components. Hence, the Indian automobile industry has a considerable impact



A diagram showing various car components which are being manufactured

on the auto component manufacturing industry.

India attracts international auto component leaders

India's auto components industry's market share has significantly expanded, led by increasing demand for automobiles by the growing working population, expanding middle class and exports globally. The two-wheeler segment dominated the automobile industry because of the Indian middle class. Due to the remarkable growth in demand for Indian auto components, several Indian and international players have entered the auto component manufacturing industry.

The automobile component industry's turnover stood at ₹4.20 lakh crore ($56.5 billion) in FY 2021-22. The industry had revenue growth of 23% over the previous year. As per the Automobile Component Manufacturers Association forecast, the auto component industry is projected to record $200 billion in revenue by 2026 and exports from India are expected to reach $ 30 billion by 2026. Strong international demand and a resurgence in the local original equipment and aftermarket segments are predicted to help the auto component industry grow by 20-23% in FY 2022-23.

The overall Indian automotive market is expected to grow at a compound annual growth rate of 11.30% from 2020 to 2027 and to be the world's third largest automotive market in terms of volume by 2030.

The rapidly globalising world is creating new opportunities for the transportation industry, especially while shifting towards electric, electronic, and hybrid cars, which are deemed more efficient, safe, and reliable modes of transportation. Over the next decade, this will lead to new verticals and opportunities for auto component manufacturers. To adjust to the shifting dynamics of the sector, the Indian government has already offered various production incentives to support them.

And due to low production costs and relatively high profit margins, India is one of the world's largest producers of automotive components. Also the expanding involvement of multinational car OEMs in the Indian auto component business has resulted in a considerable increase in component localisation.

Promising future

Today's economies are dramatically changing, triggered by development in emerging markets, the accelerated rise of new technologies, sustainability policies, and changing consumer preferences around ownership. Digitisation, increasing automation, and new business models have revolutionised other industries, and the automotive industry will be no exception. These forces are giving rise to four disruptive technology-driven trends in the automotive sector: diverse mobility, autonomous driving, electrification, and connectivity, which are creating new business opportunities in the auto component industry.

Most industry players and experts agree that the four trends will reinforce and accelerate one another, and that the automotive industry is ripe for disruption, driven by shared mobility, connectivity services, and feature upgrades. New business models could expand automotive revenue pools by about 30%.

Connectivity, and later autonomous technology, will increasingly allow the car to become a platform for drivers and passengers to use their time in transit to consume novel forms of media and services or dedicate the freed-up time to other personal activities. The increasing speed of innovation, especially in software-based systems, will require cars to be upgradable. As shared mobility solutions with shorter life cycles will become more common, consumers will be constantly aware of technological advances, which will further increase demand for upgradability in privately used cars as well.

Meanwhile, the market introduction of Advanced Driver Assistance System (ADAS) has shown that the primary challenges impeding faster market penetration are pricing, consumer understanding, and safety/security issues. Regarding technological readiness, tech players and start-ups will likely also play an important role in the development of autonomous vehicles. Regulation and consumer acceptance may represent additional hurdles for autonomous vehicles. However, once

Due to low production costs and relatively high profit margins, India is one of the world's largest producers of automotive components

these challenges are addressed, autonomous vehicles will offer tremendous value for consumers, for example, the ability to work while commuting, or the convenience of using social media or watching movies while travelling. Fully autonomous vehicles are unlikely to be 15% of new car sold in 2030.

Software competence – A game-changing development

In another game-changing development, software competence is increasingly becoming one of the most important differentiating factors for the industry, for various domain areas, including ADAS, safety, connectivity, and infotainment. Furthermore, as cars are increasingly integrated into the connected world, automakers will have no choice but to participate in the new mobility ecosystems that emerge as a result of technological and consumer trends.

In recent years, several automobile OEM manufacturers have shifted their plants to India, so the demand for automotive components has increased. Component manufacturers might have many challenges, like rising production costs, delivery time, manpower shortages, or increases in wages. Leading parts makers in India have been forced to look at other derisking options due to rising input costs, thereby giving the country an opportunity to become a major manufacturing hub.

Stricter emission regulations, lower battery costs, more widely available charging infrastructure, and increasing consumer acceptance will create new and strong momentum for penetration of electrified vehicles (hybrid, plug-in, battery electric, and fuel cell) in the coming years. The speed of adoption will be determined by the interaction of consumer pull and regulatory push, which will vary strongly at the regional and local level.

New avenues

Diverging markets will create opportunities for new players, which will initially focus on a few selected steps along the value chain and target only specific, economically attractive market segments—and then expand from there. While Tesla, Google, and Apple currently generate significant interest, we believe that they represent just the tip of the iceberg. Many more new players are likely to enter the market, especially cash-rich high-tech companies and start-ups. These new entrants from outside the industry are also wielding more influence with consumers and regulators, that is, generating interest in new mobility forms and lobbying for favourable regulation of new technologies.

Success in 2030 will require automotive component players to shift to a continuous process of anticipating new market trends, exploring alternatives and complements to the traditional business model, and exploring new mobility business models and their economic and consumer viability. This will require a sophisticated degree of scenario planning and agility to identify and scale new attractive business models.

Industry's healthy growth

India is also investing heavily in electric car infrastructure as we need to find alternatives that are cheaper, affordable, safe and sustainable. While the industry is busy dealing with these problems the consumers are scared with news of EVs burning into flames. We need to find solutions as per the Indian standards. Batteries are the heart of EVs. Any compromise with that will lead to unpleasant results. From the manufacturing industry's point of view, auto component suppliers and toolmakers that are specifically focused on engines and related components will have to strategize their business operations. Since EVs will not have engines and powertrains, companies will have to make a gradual shift towards other components of the vehicle in order to sustain the business.

The Indian auto-components industry has experienced healthy growth over the last few years and is expected to further grow to $ 200 billion by 2026. The industry has also witnessed a drastic evolution in important technological advancements. Therefore, remaining competitive could pose a greater challenge than many manufacturers realise. □

Adopting design for manufacturing for efficiency

The fundamentals of any Design For Manufacturing (DFM) system are design principles that are structured to help the designer reduce cost and difficulty in manufacturing the product. DFM as a concept is at least 100 years old, drawing roots from the first production line. This article highlights why DFM is important, as it's about creating the process for the product as much as the product itself.

Vineet Seth
Managing Director – South Asia & Middle East, Mastercam APAC

Design is defined as a visual communication of the intent, form, materials, functions, dimensions, and qualities thereof of a product. Nearly all physical products that are used or seen in the daily lives, for example, a mobile phone, a chair, or even the pen, were once just a concept in a designer's mind. An interesting thing, however, is that while the designer's mind runs carefree on creativity, there are often barriers to making the product idea manufacturable in a practical sense. Consider the design of an everyday product for the sake of stripping down the different areas of design and manufacture—say a water container. What would you think from the perspective of design and manufacturability? What are the questions you would ask or consider from the point of view of form/shape, purpose, function, dimension, durability, cost, quantity, material, etc?

All of the questions above, and probably an equal number more, are what would cross an engineer's mind when they adopt the Design for Manufacture process, usually at the ideation stage. But why for manufacturing? Why not something else?

Practical design – Heart of DFM

It is vital to understand that the manufacturing process for

The process and cost of making the product depend on its characteristics, which include the design idea, material, quality, durability, and process of making the product

the water container that we discussed above can be as simple as hammering a rectangular tin foil into a cylinder and closing the open ends with a lid, or chopping a hollow bamboo and tying the end with an oilcloth, or developing an efficient blow mould tool that produces a thousand PET bottles an hour! What we notice here is that manufacturing plays an essential and central role in controlling the time, cost, and quality of the product that is being manufactured. This is an elastic band, depending largely on the interplay between many characteristics that we will discuss ahead.

I realised, through my pondering of the above example, that while we can imagine many things and make most of them, often the most successful designs are those, that are also practical—scalable, adaptable, and economically viable. What then is practicality or practical design?

Well, practicality is at the heart of Design for Manufacturing, or DFM, as it is often abbreviated.

Influencing factors during product lifecycle

Considering that there are different verticals or heads within what practicality means to different people, the majority of these characteristics can be broadly classified under: the design idea, the material, the quality or durability of the product, the process of making the product, and finally, the cost of making the product.

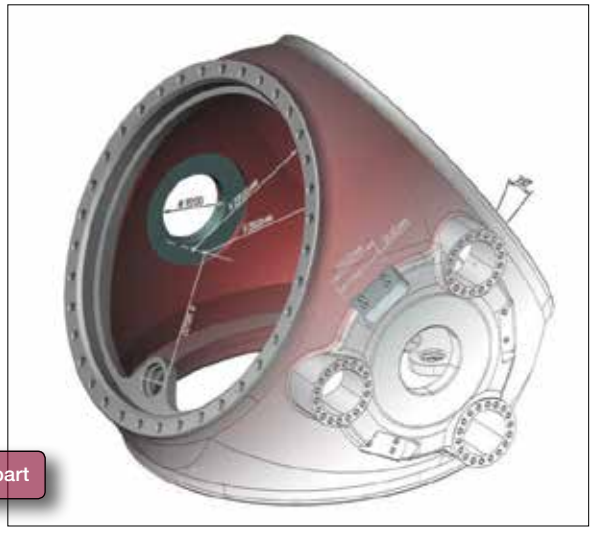
It is important to understand that all of the above heads influence one or all other heads at some time or the other during the lifecycle of the product. In essence, the final product, after being duly considered for its many different characteristics, will more often be an optimal output of the core rules (or the minimum acceptability criteria) laid down for each of the individual heads. One can also call it an acceptable compromise, but then again, we will end up with the glass half-full or half-empty analogy. Further, the Design for Manufacturing process is not linear but rather circular in nature. What this means is that each iterative step keeps improving the collective process until the system has reached an optimal state. DFM, which is an integral part of concurrent engineering, as a concept is at least 100 years old, drawing roots from the first production line!

Design idea stage

This stage is all about the problem statement or the answer to a problem statement in sometimes vague but relatable terms. It also includes a large part of visualisation such as preparing sketches, drawings, CAD models, and more often than none, physical prototypes. At this stage, a minimum number of acceptable characteristics is defined, typically using the age-old must haves and good to haves of each head. Interestingly, this is also one of the critical stages responsible for the standardisation aspect that we see in nearly every product. This process also considers the aspects of tool & auxiliary design, Design of implements and sub-processes, test and reliability design as well as end-of-life design. In mechanical designs, some of the core design features are likely to be wall thickness, fillet radii, chamfers, length to diameter ratio, overhang, support ribs, surface flow, fastening and joining mechanisms, sliding and rotating mechanisms, suspension mechanisms, and sealing mechanisms, amongst many other critical features. This process also includes a simulation or validation phase, which starts with assumed inputs and refines the design based on inputs from the remaining heads in the DFM process, often in the analysis of strength, fatigue, flow characteristics, thermal effect, chemical reactivity, efficiency, etc.

Selection of material

The next head, selection of material is based on the desired physical properties of the end product. This stage considers mechanical, optical, aesthetic, electrical, thermal,



A technical drawing of the drafting part

chemical, and a host of other related properties. Starting with how strong, flexible or stiff a material should be, or what colour, how lustrous or not, transparent, translucent or opaque the material should be or what patterns, lines or texture the material should have, to how the material must handle moisture, chemical exposure, electricity, and also the feel and touch of it, while being handled or used. As mentioned earlier, each of the above comes at the cost of one or more characteristics, in what is commonly referred to as trade-offs. Historically, materials are known to be one of the biggest cost components of the final product costs. It is due to this factor that there has been so much innovation in material technology. To appreciate this, let's just wonder for a moment on how small microchip processors have become since the time they were used on the first computer!

Quality of product

Having established the material characteristics, we are now left with understanding that durability, weatherability, fit and finish, looks and appeal, conformance to dimensional specifications, etc, are what comprise quality. In certain ways, this head also has a strong influence on the material at times. While quality has undergone several definitions since the industrial revolution, the core aspects of functional durability at reasonable cost have arguably been prevalent since the stone age. This process also draws from the sub-processes in the design phase to test and certify that the product conforms to the design specifications. Until a few decades ago, quality was considered a cost. However, with PLM and DFM processes, it has been demonstrated that quality actually saves huge costs over the lifecycle of the product.

The process of making the product is normally a function of the demand that exists for the product (or how much of the products are to be made in one go), the time required to make it (how soon is the product needed) and the available equipment to make the product efficiently and accurately (eg, moulding, stamping, milling, spinning, welding, 3D Printing, casting, turning and the list goes on!). This process also depends on what kind of material will be used, as the same process can yield different timing and costs for different materials! To add to the decision-making chaos, a simple tweak in the design may significantly reduce the manufacturing process or get rid of some sub-processes entirely. This is not all; the expectation of quality from the consumers of the product in question also alters the manufacturing process and methods at times.

Reducing costs with effective DFM

The sum total of all of the previous processes creates a minimum cost for the product, without which the product cannot be made as per set or defined standards. This has, since time immemorial, been the key to defining what we have come to understand as a value proposition. Of course, there are other costs related to people, administration, logistics, marketing, and statutory taxes, among others, but somehow manufacturing has been able to reduce costs in the core processes. How is that? One may ask, and the answer will point to effective DFM.

What if the design could not be manufactured? Or worse, it could be manufactured, but at a cost that will make it unaffordable. What if it could be manufactured economically but wouldn't last a day? What if it could be manufactured economically, last for a reasonable time, but not be transported easily? What if it could be transported easily but did not have aesthetic appeal? What if it had aesthetic appeal but lacked the necessary grip and ergonomics to handle it while performing other tasks?

These questions can go on until they start looping back – eventually towards manufacturability and efficient manufacturing. □

Achieving a manufacturing edge

Custom tooling requires machines that are designed to be simple and flexible. Addressing these needs, ANCA machines and software offer a high degree of flexibility to make impressive tools for customers. Here the feature explains; how ANCA's customised solutions provide a competitive edge in the industry.

The market for PET (Polyethylene Terephthalate) food & accessories indexable inserts is a significant opportunity for tool manufacturers. Market data indicates that not only is the value of the inserts market larger than the solid cutting tools market, but its annual rate of growth is also higher. These facts provide a strong incentive to be active in this market but insert manufacturers must tackle unique and widely varied challenges for competitive insert production.

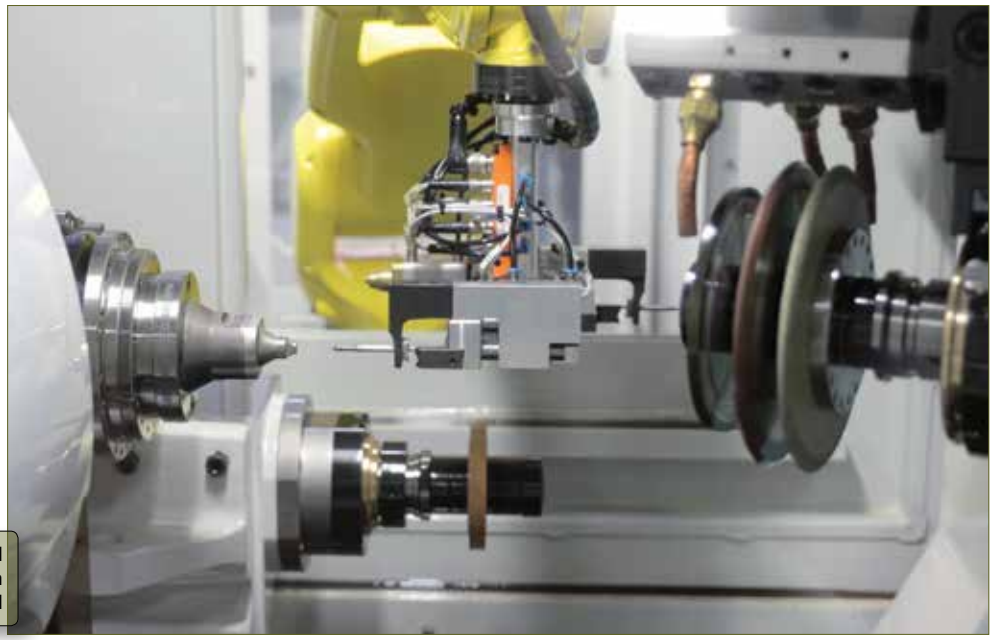
Providing cutting-edge geometries

The enormous diversity in insert geometry demands a partner who can deliver grinding machines with solutions in automation, work holding and programming software that can be adapted to the unique features and cutting-edge geometries seen in the inserts market.

AB Tool Inc (California, USA) has been the first of a number of insert manufacturers that worked closely with ANCA engineers to deliver solutions to these challenges. By systematically addressing the key elements of insert geometry and the required tooling and automation, ANCA has developed a suite of solutions, based on its MX grinding machine platform, that is adaptable to a wide variety of insert designs. Indexable inserts account for a significant portion of the broader insert market and their uses are wide and varied.

Offering flexible solutions

Whether for cutting, turning, parting, scarfing, hobbing, profiling or threading – insert applications and their designs are seemingly limitless. Both standard ISO and special form inserts can be ground with ANCA solutions but given ANCA's



Automation for unattended production is also designed with flexibility and efficiency in mind

track record of developing highly flexible and adaptable application software and automation, ANCA customers tend to be focused on the 'special insert' application where geometries and cutting features are more complex, but the financial rewards are greater. ANCA's latest software developments include digitising routines to accurately locate insert position and index or datum features. Tool programming software includes a variety of grinding operations that allow customers to produce both 'on edge' (or tangential cutting) inserts as well as 'lay down' (or axial cutting) inserts.

Addressing customer demands

Using ANCA's CIM3D, the complete part grinding process in the machine can be visualised and the finished insert checked and reviewed before true grinding starts.

Equally important are the tooling and automation solutions that can be readily adapted to account for the various insert geometries presented by different applications. On the MX machine platform, ANCA has developed modular solutions that can be customised and adapted to unique customer needs.

This system is offered with custom tooling to accommodate different insert hole diameters and geometry as well as varying thicknesses. Variable pin clamp force is also offered as an option to account for different grinding forces generated when grinding different-sized inserts.

Collaborative approach

Inserts can be presented on industry-standard plastic pallets, allowing one pallet to be used for a variety of insert shapes and sizes. The robot tooling used to pick up and load the insert is also designed to customer requirements and will handle varying insert sizes, thicknesses and shapes.

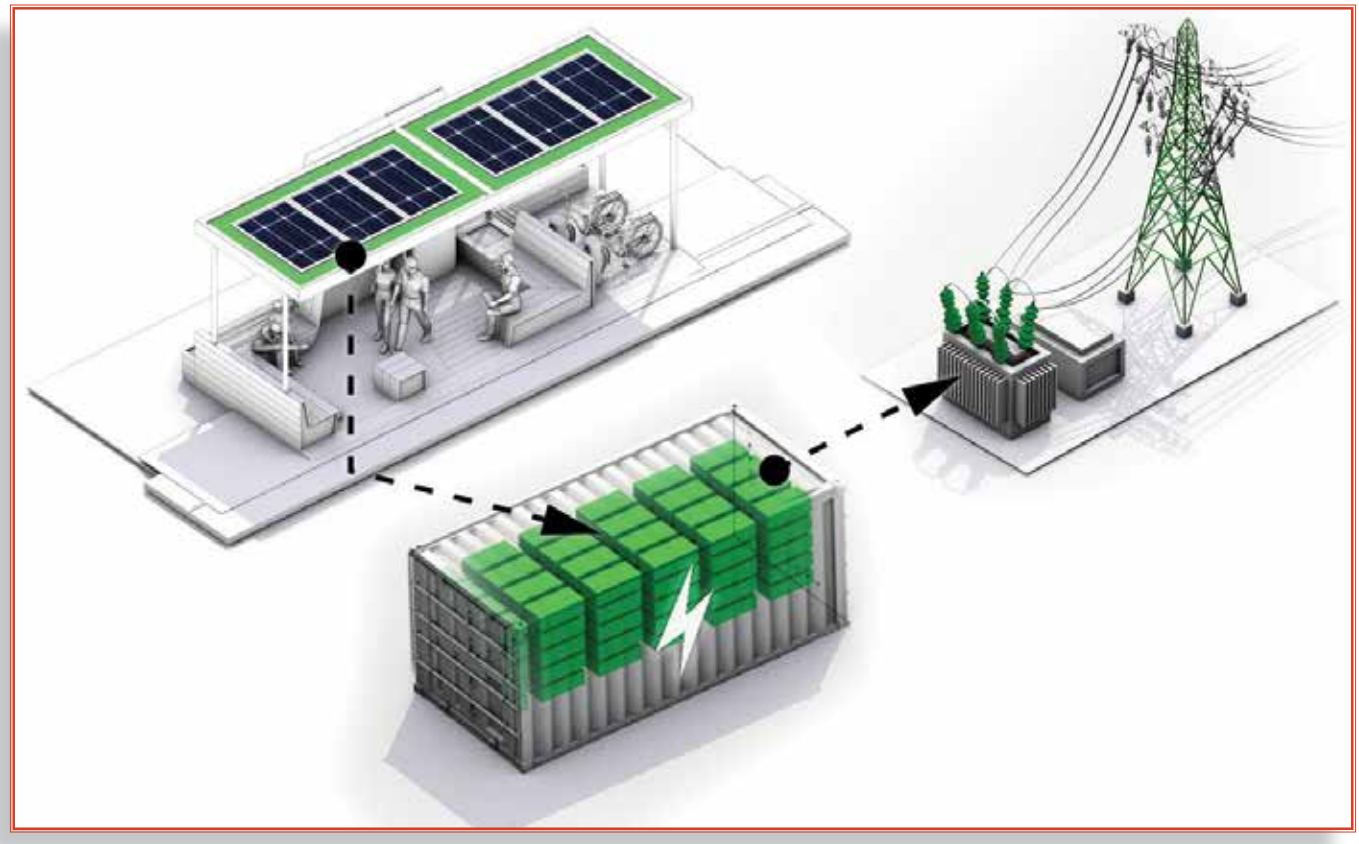
These modular and adaptable solutions for special insert production have been the result of close cooperation between customers and ANCA design and development engineers. Such a collaborative approach has ensured that customers' specific needs have been answered and the foundations are laid for solutions for other customers looking to gain an edge in the lucrative market of special inserts.

Creating advanced manufacturing solutions

ANCA, as a company with nearly 50 years of experience in advanced manufacturing is highly vertically integrated – meaning responding to specific customer needs with new technology is agile. A heritage of first-to-market innovations has been driven by listening to customers and responding to their manufacturing challenges.

According to Pat Boland, Co-founder and Joint Managing Director, ANCA, "Designing the best technology requires a multi-pronged approach. We immerse ourselves in the market; are continually inventing; keep a keen eye on new developments and bring them into our applications. We seek out intelligent, talented people, and interact with customers daily to understand their specific needs. This is how we design and manufacture our market-leading solutions." □

Courtesy: ANCA CNC Machines



Why are Li-ion batteries preferred in the EV segment?

With the constant push for green mobility by the Government of India and people's inclination to contribute to environmental safety, the adoption of electric vehicles is picking up pace in the country. This column illustrates why lithium-ion batteries are one of the most popular types of rechargeable batteries, which offer efficient charging.

Akash Agarwal,
Senior Marketing and System Manager,
Analog Devices

As India has an ambitious target of achieving 100% EV adoption by 2030, the government is continuously coming up with appropriate incentives to push the sector's growth. The 100% FDI provision has encouraged the players to manufacture world-class vehicles and accelerate EV penetration. According to the Minister of State for Heavy Industries, a total of 3.11 lakh EVs were sold in 2021. And, till the first half of 2022, 4.19 lakh EVs were sold. This is quite encouraging for all the stakeholders, especially electric vehicle and battery manufacturers. However, despite all efforts, manufacturers are attracting criticism from consumers for the unwanted events of vehicles supported by Li-ion batteries catching fire over the last few months. These are unfortunate events and not good for the health of the industry and the overall EV growth ambitions of India.

Safety norms for manufacturers

To deter such incidents, the government is working to formulate safety norms that manufacturers will have to adhere to. It will soon release a notification to mandate amended AIS 156 and AIS 038 for the respective categories. The additions to the standard provide an additional test to avoid fire incidents in the future. It will also introduce battery certification to ensure safety and deter fire incidents. Recently, the Bureau of Indian Standards (BIS) has come up with a new standard, 'IS 17855: 2022' which is about the testing procedure of the characteristics of performance, reliability, and electrical functionality of EV battery packs.

Considering the situation and the negative impact the recent fire incidents have generated on EV growth, EV and

battery manufacturers are in constant pursuit of the best ways to deliver quality battery solutions and ensure the safety of their valued consumers.

Why do EV catch fire?

The rising temperature of cities and the poor thermal management of Li-ion batteries are considered the key reasons behind the fire, but that's not true. The major causes are battery abuse, cell or pack manufacturing defects, and short circuits leading to abnormal changes in chemical reactions within the battery cells. Also, lithium-ion batteries sometimes undergo thermal runaway when the cell temperature rises rapidly and the amount of heat generated exceeds the amount of heat dissipated. This situation, when it goes undetected, results in Li-ion batteries catching fire.

Thermal runaway is the most hazardous battery safety problem, and it can eventually lead to dangerous results, such as fire or explosion of the battery. For preventing thermal runaway, diagnosis and prognosis of the potential causes are important. There are numerous causes of thermal runaways, like internal short circuits caused by physical damage, overcharging of the battery beyond its maximum voltage, and battery temperatures outside the safe region either on the low side or the high side. The government, in its new amended safety regulation, has mandated a warning system for a thermal runway event.

How can an efficient Battery Management System (BMS) help?

Once a battery reaches a thermal runaway state, it is very difficult to contain its impact. Hence, the cause of the thermal runaway needs to be prevented and avoided. Also, one of the key aspects of Li-ion batteries is that they need to be constantly monitored, whether in parking or during shipment, as the batteries are always on.

An efficient Battery Management System (BMS), which is responsible for maintaining the battery in a safe operating area and always monitoring the battery, prevent the rise of short circuit current to abnormal limits, performs its duties efficiently, it can prevent thermal runaway events and eventually prevent fire. An inefficient BMS that fails to perform its duties will not be able to detect any warning signs and eventually will not be able to prevent a thermal runaway.

Characteristics of Li-ion batteries

Lithium-ion batteries are one of the most popular types of rechargeable batteries. Due to the various advantages it offers, it is preferred in the EV segment. Advantages like the best energy-to-weight ratios, high energy density, high open circuit voltage, and low self-discharge rate make them fit for vehicles. Besides, their inherent safe chemistry, longer life cycle, efficient charging, and ability to operate at low temperatures make them the best batteries for EVs.

However, certain internal changes due to improper use of the battery or abuse of the battery can lead to a fire in Li-ion batteries. But it can be prevented by adopting some proactive approaches and technical robustness at the manufacturing stage.

What manufacturers can do during the manufacturing process?

Manufacturers very well understand that batteries are not only the powerhouse for vehicles but also an important component in determining the features that matter to customers. Recognising this fact, they are continuously working to invent new technology and try new chemistries and configurations to improve battery pack performance and enhance safety features. However, they should increase their focus on some key elements during manufacturing.

They must work to make the BMS smarter, which will help in avoiding mishaps, and develop a battery monitoring system as per the requirements of the local environment. They can make this electronic system more robust to limit battery functions within its safe operating range. Through this concept, rechargeable

Li-ion batteries are the costliest and a critical component in an electrical vehicle

battery cells can be managed better while ensuring proper monitoring of every cell. It can further help in monitoring the battery's state, controlling its environment, calculating data, and reporting the same. During the charging and discharging of cells, maximum efficiency can be ensured with the help of the system.

With an efficient BMS, manufacturers can ensure effective thermal management during cell balancing, better monitoring of cell temperatures, managing charging current, and managing charge and discharge voltage to increase battery life, performance, and safety. While developing batteries, manufacturers must check the BMS and its efficacy in performing these tasks. Another good method that manufacturers can adopt to enhance battery safety is passive thermal management. In this method, a cooling method is used that absorbs extra heat through different thermodynamic processes such as radiation, conduction, and convection. This is an easier cooling process for smaller and midsize batteries as compared to active cooling.

Apart from that, manufacturers can also think about using Latent Heat Systems (LHS) materials to increase battery safety. These materials absorb and store energy and reduce the hazardous thermal effects. They can prevent thermal runaway, keeping the temperature in equilibrium across the cells, and reducing the incidences of battery overheating. At the same time, the battery needs protection from short circuit conditions which occur due to certain system failures. BMS should be able to detect the short circuit condition as early as possible & take appropriate remedial measures to break the current path in the system. An efficient BMS will be able to restrict the rise of the short-circuit current flowing in the system. Controlling short circuits is important, as they can lead to a high-current situation beyond the control of the system. Many internal and external faults can cause a short-circuit current. External faults such as mechanical damage, motor damage, or internal battery damage are some reasons for short circuit conditions. One of the reasons can be short circuits within the cell components (cathode and anode). This happens due to a faulty battery, poor battery design, cheaper quality, improper handling of the event, & more. To avoid such cases, manufacturers must use the best quality battery components and conduct extensive tests before launching the products in the market.

Measures required from consumers

Manufacturers' actions alone are not enough to ensure battery safety. EVs demand equal care and attention from consumers. They must follow all the operating instructions provided by the manufacturer during the purchase. For instance, if they are going for any repair work, they should ensure the use of only components recommended by the manufacturer and not look to save a few bucks, especially on the battery and the associated components. Their precautionary steps will save them from any unfortunate events. It is also important to use the manufactured, provided, or recommended genuine chargers only to recharge the batteries. A faulty charger or unmonitored charging can impact both battery life and safety.

Electric vehicles are the future and the best way to combat rising fossil fuel prices and environmental deterioration. Quick adoption of EVs must be emphasised which is possible only when complete safety and unflinching trust is developed among the customers. This is will make everyone future-ready with appropriate solutions for upcoming challenges. In this endeavour, global leaders in the design and manufacturing of analog, mixed-signal, integrated circuits and semiconductors can help battery manufacturers immensely in developing a safe and secure battery management system for current and future battery technology.

Driving to the future

Li-ion batteries are the costliest and a critical component in an electrical vehicle. Li-ion batteries offer a path towards a green and pollution-free transportation option. But they need to be handled with care. The safety and protection of the Li-ion batteries is a shared responsibility between the cell manufacturers, equipment manufacturers and also consumers. All the stakeholders should work together to ensure that the entire journey of the batteries, from the manufacturing to the pack assembly to the usage in the vehicle, is safe and protected. □

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VISION

Taking a sustainable route to power the water industry

With the rapid pace of industrialisation over the past few years, the industrial sector has been the main source of inadequately treated wastewater. With environmental awareness expanding around the world, the process of water treatment has been the talking point as efforts. Neha Basudkar Ghate, EM caught up with Tanmeet Gulati, Commercial Leader, Pacific, DuPont Water Solutions, and Chrys Fernandes, Business Head - India subcontinent, DuPont Water Solutions who threw light on wastewater treatment and how they are working on it.

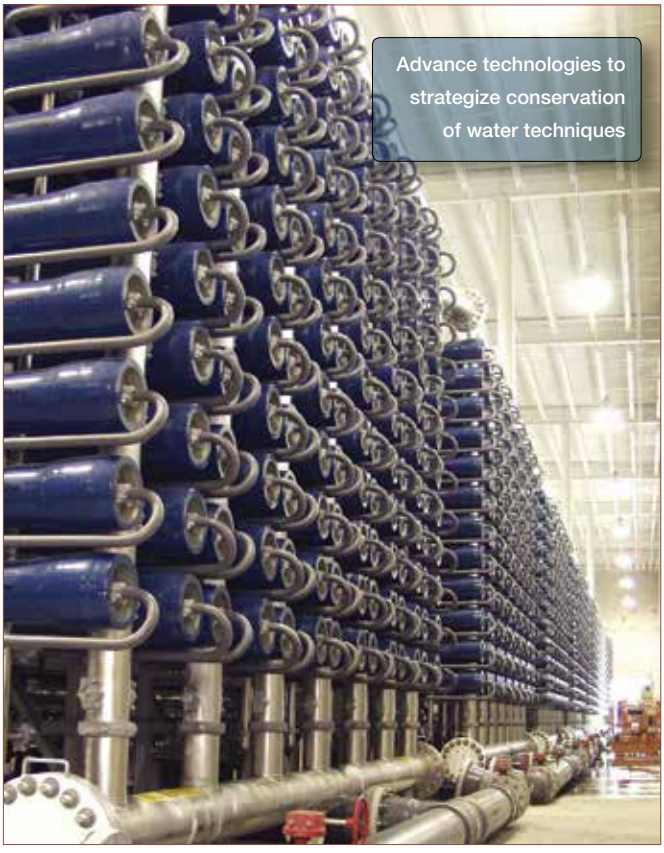
Chrys Fernandes
Business Head – India Subregion
DuPont Water Solutions

Tanmeet Gulati
Commercial Leader, Pacific
DuPont Water Solutions

The disposal of industrial effluent has become a high-priority issue today. Industrial waste typically contains pollutants that must be treated before being reused or disposed of in bodies of water. India is set to become an industrial hub in several crucial sectors. This marks a huge potential to upscale the industrial wastewater treatment processes that will not only save water but can also serve as an example of sustainable models to adopt. Therefore, to investigate the issue of effluents and foster clean water solutions for a sustainable tomorrow, DuPont Water Solutions (DWS), a global leader in water purification and separation technologies, featured its range of water solutions and technologies at IFAT in Mumbai from September 28-30, 2022.

Addressing environmental challenges

With an objective to solve the pressing environmental concerns focused on the water management, sewage, solid


Advance technologies to strategize conservation of water techniques

waste, and recycling segments, the three-day event provided a robust platform to connect with customers, partners and showcase the company's advanced technologies – from ion exchange resins to reverse osmosis membranes, and from ultrafiltration membranes to electro deionisation techniques. During an interaction, Tanmeet Gulati, Commercial Leader, Pacific, DuPont Water Solutions, said, "DuPont's work across four segments includes residential & commercial, industrial water and desalination, municipal water treatment, life sciences and specialties."

He emphasised that industrial and desalination are the two biggest segments in their portfolio. "However, in India, there are three mega trends in development: wastewater treatment, zero liquid discharge (ZLD) or minimal liquid discharge (MLD). And the governments are strategizing to conserve water. The industries are into reusing water and for that, they require the water treatment technologies like Reverse Osmosis (RO), to enable the industries into wastewater treatment," he continued. Speaking about desalinisation, he mentioned, "Desalinisation is similar to wastewater treatment. To make seawater usable, the salt content must be separated, and enhanced technologies are required. We have all kinds of components, like Reverse Osmosis (RO), Ultrafiltration (UF), which can help with desalination. These trends can provide a boom for the water treatment industry."

Ion exchange resin technology in the pharma industry

Chrys Fernandes, Business Head - India subcontinent, DuPont Water Solutions, explained how ion exchange resin technology is also used in the pharmaceutical industry. He stated, "During the manufacturing of a drug that is made over a palladium or platinum catalyst, it must be purified, and that is where our resin is used in the purification of the drug, by selectively removing the catalyst."

"Our specialty membranes are also used in the concentration of the drugs in the fermented broth. Let's take an antibiotic, for example. The membrane is used in the concentration of the drug. Water used in the pharmaceutical plant is produced over a special membrane. It must be sanitised and operated at very high temperatures. There are various variants of RO membrane, some of these are used for just water purification, pharmaceutical purposes, or dairy applications," Fernandes added.

India becoming a hub in the microelectronics industry

While citing India as a business hub in the coming future, Fernandes asserted that, among the several crucial business portfolios, India has the potential to become a hub in the microelectronics industry. "These industries require ultra-pure water, and we offer those technologies, Ion exchange resins and RO which are used singly or in combination to help these industries achieve the high level of purity that they need during the water manufacturing process."

Fernandes also illustrated this scenario with an example. In GIDC, in the Dahej industrial estate, the companies have built a 100 MLD desalination plant, and they use UF and RO. "For them, we have provided dry seawater RO, which uses less water during the production of the membranes and is also easier to install, commission, and start-up."

In Chennai, the municipal corporation treats wastewater,

To get the right output, industries should adopt suitable technology for their effluent water treatment

puts it through an advanced treatment process that uses UF and RO and supplies water to industries for their use. Now, instead of drawing fresh water from lakes, industries get recycled water, and the freshwater is available to consumers.

According to Fernandes, "A few years ago, the percentage of wastewater or effluent water that was treated was very low, but now that is steadily going up. If we generate 100 litres of water now, only 40 litres of water are collected. And of these 40 litres, there is a small percentage that is treated. Hence, there is a huge potential here."

Similarly, Gulati gave a stunning example of how a drought-prone region is reserving underground water for its future generations. He explained that Western Australia, a drought-prone region, does not get underground water, and hence, they have put in desalination plants to serve the community for water. Not only this, but they are also steps ahead as they are treating all the collected wastewater and recharging the groundwater so that their future generation, who are 25 years down the line, has water. "We are partnering with all desalination plants in Western Australia," he added.

Indian towards a sustainable future

Gulati further explained how India is walking on the path of sustainability, "We are working with two trends. Since the government is emphasising regulations, we are educating the industries about the solutions we have available. Industries can adopt the solutions that we provide and meet the standards that the government is setting. Secondly, industries are very much aware now, so all the conglomerates want to be sustainable along with the local Indian companies," he explained.

India has progressed well towards using alternative sources of water. As per Gulati, "With the stringent government regulations and people getting educated, the only question is how fast we can achieve the sustainability goal."

Treating wastewater

Gulati also noted the amazing concept of 'New Water'. He shared that Singapore uses treated sewage or industrial wastewater as an alternate water source for industrial use and drinking water. It is branded as New Water.

In simple words, Fernandes shed light on how waste and effluent water can turn into drinking water. "Treating wastewater is like a closed loop cycle; the water that the industry uses is again treated back into the plant, which is reusable. When you have wastewater, it has some organics - some inorganics, and impurities that are dissolved and/or suspended. Today you have technologies to remove all suspended materials, and all the dissolved materials. After you remove these impurities, you're left with pure H_2O. Then what stops you to drink back the same H_2O. This requires a mindset change," he discussed.

Selecting the right technology

Wrapping it up, Gulati concluded, "To get the results, you need to pick the technology depending upon what quality of water you require, what quality of water you are getting, and then combine those technologies together to get the right output."

"That's what we do as a company. We have simulation software with which we help design and optimise the plant and provide the system integrator with a design basis. Based on this design, they assemble all the components and run the system." he added. □

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Advancement of lasers in welding

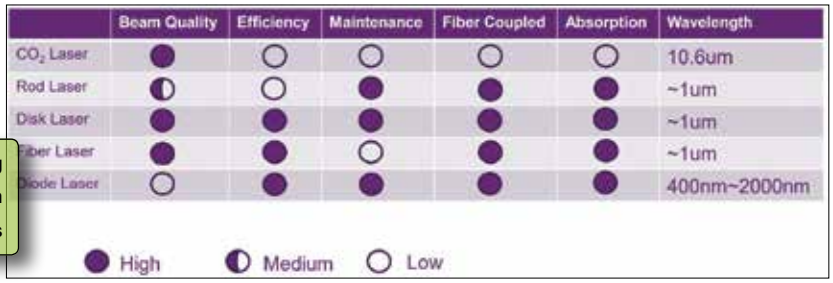
For years, laser technology has evolved and has found its usage in various industries and applications. Lasers of various kinds are now commercially available, ranging in power levels from a few watts to kilowatts, meeting numerous application demands. The article sheds light on the growth of lasers in the field of welding.

Amitava Sen,
Technical Manager – Surface Coating,
Hoganas India

In 1917, Einstein formulated the theory of stimulated emission and laid the groundwork for the laser. In addition, laser cladding started for industrial applications during the early 80's. A laser in welding is used for both joining, hard facing and build-up. Joining is carried out with both filler and non-filler and is used for various critical and non-critical applications. Due to its very low heat input to the substrate materials, it has the versatility to be used for very difficult to weld materials too. Laser cladding has been known for about 50 years, and in recent times, it has reached a more general industrial acceptance. At present, laser equipment requires higher investment costs compared to other coating processes like PTA, thermal spray, GMAW, etc. The benefits of laser cladding show lower heat input, lower dilution, less material consumption, and overall better. With the last decade's development of high-power laser sources from 10 µm wavelength CO_2 lasers to high-power solid-state lasers with wavelengths of around 1 µm, improved process efficiency, lower costs, and smaller footprints have been achieved. As a result, laser cladding has rapidly become more interesting for a wide variety of applications. Laser cladding is a more efficient process for sustainability, environmental effects, and consumable availability.

Laser cladding

Laser cladding uses higher laser power in general, greater than 1 kilowatt of power as a heat source to form a cladding layer on the processing substrate. Laser cladding processes involve melting and feeding a metal stream into a melting pool generated



Various laser generating types with their wavelength and typical attributes

by a laser beam while scanning through the target surface and depositing the layer of the material selected and partial melting of the substrate surface wherein the cladding is involved. Laser cladding is carried out either with a wire or powder feedstock, including hot or cold wire. Laser cladding can be achieved by appropriate selection and control of processing parameters such as laser beam, power density, laser beam travel speed, and laser beam diameter at the workpiece surface.

Four attributes which make the laser an efficient method:

- Low beam divergence – resulting in very high focus. This makes the process very precise and energy-efficient
- High power and high intensity – Power density at focal spot = 10^6 – 10^{17} W/cm^2. At such high intensities, any material can be melted and evaporated, even formed plasma with a focused laser beam
- Lasers of varied wavelengths can be formed from different laser-generating sources. The absorption and focus beam depend on the wavelength (λ) of the laser beam
- Wide range of laser pulse duration
  – Continuous wave (CW)
  – Pulsed lasers

Millisecond pulses (10^{-3} s), microsecond, (10^{-6} s) nanosecond (10^{-9} s), picosecond (10^{-12} s) down to a few femtosecond (10^{-15} s).

The process

In the process of LC, the dilution, aspect ratio, microstructure, and mechanical properties of the cladding layer are closely related to the laser power, scanning rate, powder-feeding rate, scanning method, defocus amount, and other process parameters. To obtain a cladding layer with a fine microstructure, uniform composition, and good mechanical properties, appropriate laser cladding parameters need to be derived. Mostly, it is driven by four important settings: laser power, laser scanning rate, powder feeding rate, and type of torch used.

Laser cladding brings in the versatility of using different alloys to match various application requirements; various coating thickness requirements; can be used for various types of substrates; can achieve various coating properties using different power levels, and can coat both vertically and horizontally. Most importantly, laser coating is an environment-friendly process compared to other coating processes, and powder utilisation is the highest among the commercially used processes, making it a sustainable process.

The advantages of powders

Laser cladding uses both wires and powders as consumables, but it has been observed that powder brings the best advantages.

- Powder consumables are available in a far larger number of alloys than wire. Large pool of chemistry to suit your specific requirements.
- The dilution or HAZ zone is considerably less and thus the requirements for coating are met with a thinner deposition layer. As finer diameter wires are very difficult to manufacture.
- It is difficult to weld materials. For wire cladding, more heat input is required for melting the wire.
- Lower welding consumable requirement
- Accurate coating thickness. With finer powder size, coating thickness can be precisely controlled.
- Minimum follow-up work or machining is required

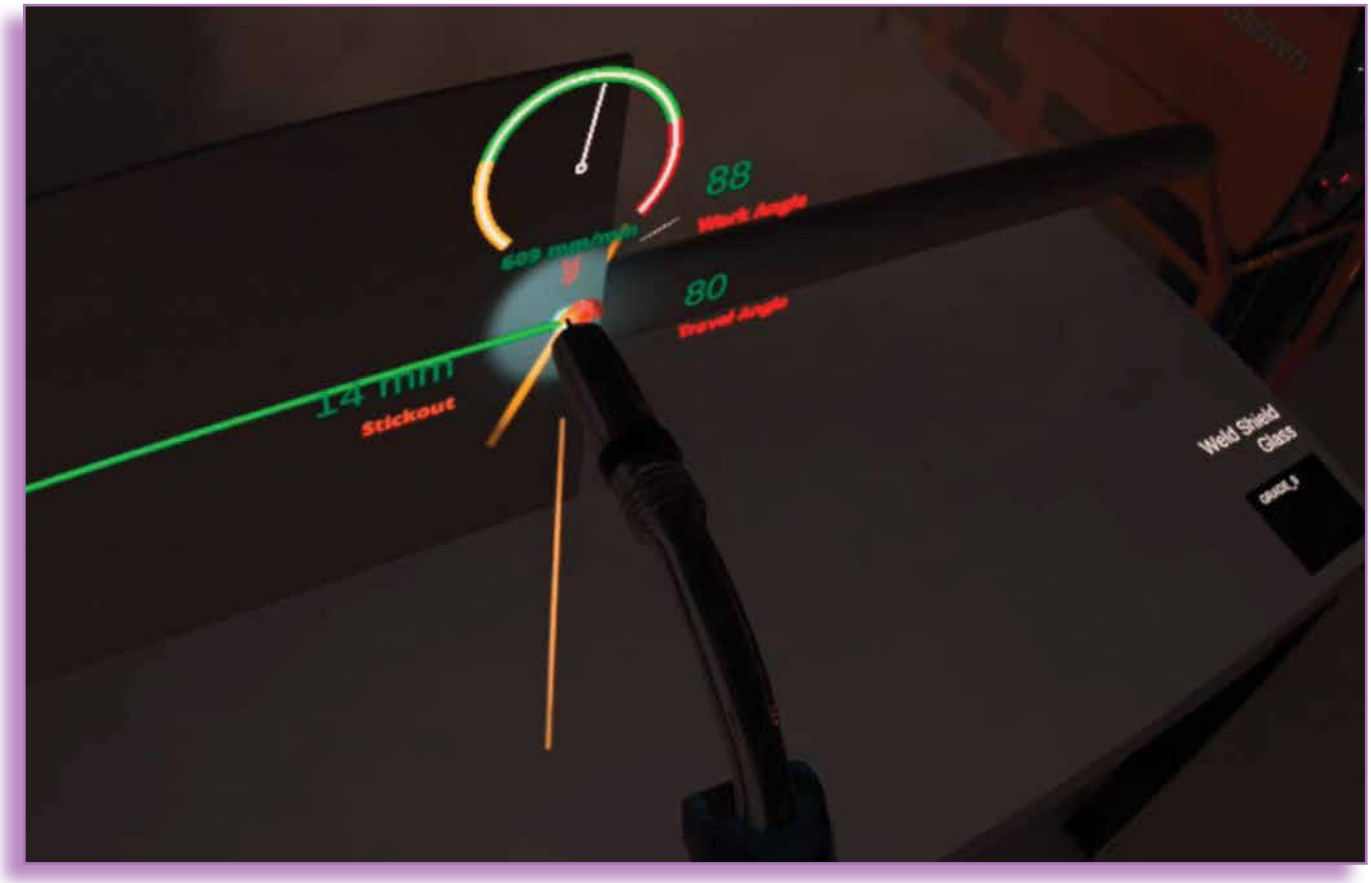
Compared to the other coating/hard facing/surface engineering techniques, the following advantages are derived by the industry:

- Lower coating thickness with the same performance. This brings a reduction in the dead weight. More power for useful work or a reduction in energy consumption,
- Due to lower heat input, repair of critical or non-weldable components becomes possible
- Choice of material as per your specific requirements because of the possibility of powder mixing and the huge pool of powder chemistry available commercially
- Life enhancement of critical components with the use of surface engineered claddings
- Consistent property
- Conversion of high-alloy cast components to less costly surface-engineered components
- More environmental-friendly and energy-efficient processes

Applications

Today, the usage of lasers has seen incredible growth and is still growing at large. □

Disclaimer: The opinions expressed in this article are those of the author. They do not purport to reflect the opinions or views of Hoganas India.



Diverse technologies come together to transform welding

Since its development in the 19th century, welding has witnessed a lot of technological advancements. With time productivity has improved while electronic and software advancements have reduced the dependency on human error. The chapter talks about the evolution in welding in terms of not just the core of welding technology but also in terms of technology involvement.

Sabarinath Nair,
CEO,
Skillveri

Welding has been around for ages. One of the earliest known forms of welding is forge welding, or solid-state welding, a process in which two metal pieces are heated and repeatedly hammered to fuse them together. One of the oldest metal structures present in India, the Iron Pillar of Delhi (about 310 AD), is a product of forge welding.

Conventional welding as we know it today was developed in the 19th century after the invention of the electrical arc and acetylene gas. The earliest arc welding process that used electrodes was developed in the 1880s. During the mid-20th century, arc welding as a form of welding had a qualitative leap with the invention of GMAW, FCAW, SMAW, GTAW, etc.

In the last few decades, we have seen a lot of technological advancements, not just in the core of welding technology but also in other forms of technology involvement.

Evolution of gas welding to arc welding

Gas welding was invented after the invention of electrode arc welding but was the preferred method due to its technology and equipment being portable and economically cheaper. The switch from gas welding to arc welding started with the availability of electricity and because arc welding provided more weldability and a higher speed of welding. The evolution of arc welding started due to the higher demand for ships during WW1 & WW2.

Arc welding started by welding metals using direct current

A screenshot from a 3D immersive welding training simulator

and a bare electrode. This evolved into the welding process, which uses a DC/AC current supply, its own welding atmosphere using gases, and electrodes providing flux to cover the weld.

Welding technology reducing the scope for human error

GMAW is the most common welding process which is extensively used in the sheet metal industry and automotive industry. Unlike other welding processes, the GMAW does not require a welder to supply filler metal externally while producing the electrical arc. In this process, the necessary filler wire is supplied through the welding gun along with the shielding gas supply.

One of the evolutions that happened in the arc welding process was the evolution of the welding machine used. The earlier machines used for arc welding had to be manually adjusted for the voltage setting based on the material type and thickness. Now it has evolved to the stage where the welding machine will set up the necessary current and wire feed rate based on the application/workpiece. This reduces the probability of human error in the preparatory process and increases the importance of the welder's technique.

IoT / Industry 4.0 adding analytics to welding process

IoT-based welding machines using advanced technology calculate the production efficiency, and the data collected will help develop a strategy to improve the productivity. These welding machines keep track of the daily usage (on/off) and the consumption of gases, current, wire, etc. This helps in evaluating the efficiency of the machine as the cycle of its usage can be tracked to keep track of its life cycle.

Robotic welding is a relatively new technology, even though the usage of robots for spot welding has been prevalent in some areas. Robotic arc welding is a fast-growing use of robots that use pre-programmed codes, a machine vision system, or both to perform the welding operation. It has many advantages, such as increased accuracy, increased productivity/throughput, repeatability, etc.

Industrial Metaverse / Virtual Reality innovations for welding

While the electronic and software advancements within welding machines have reduced the dependency on human error, the welder's hand movement is still a critical factor, and to bring robotic-level precision to that, Metaverse training will help.

Training welders in Virtual Reality / Metaverse has opened up a lot of options that were earlier not possible. With the latest advancements in sensors and virtual reality displays, one can create realistic 3D immersive lessons where a trainee can be taught not just standard welding joints, but also taught to weld on a 3D simulation of a component welded in the factory by importing the CAD drawing into the simulation.

Aspects that are not measurable in the real welding scenario, even with the modern IoT welding machines, like the welding speed, can be measured in the simulation and the quality of the output accurately predicted. Using sensors attached to real guns or using Virtual Reality to mimic the appearance of a welding gun, the dexterity of a welder can be measured with accuracy to 0.2 mm precision, and thus a weld bead can be simulated with the welding machine parameters and the welding gun movement as the inputs, and the output with quality aspects, like bead uniformity, depth of penetration, heat affected zone, porosity, spatters, etc, can be simulated.

The skill input parameters like the arc length (or stickout), weld angle, travel angle, path, and weld speed can all be measured, and therefore a defect can be accurately predicted with the simulation mathematical model. The advancements in Metaverse / Virtual Reality enable welders to understand deeply what their current dexterity skills are and in what areas they need improvement, which helps them achieve near-robotic quality in the welded output. Thus, with a combination of technologies, both productivity and quality are improved. □

Improving machine performance with technical expertise

The uncertain consumer market situation for the past couple of years have forced industries to justify the purpose of market existence by focusing on redefining their R&D strategies. The piece explains a technology perception of all the three aspects of machining centre development at BFW.

Dr Harshad Sonawane
Head- Research and Development activities, Dr Kalam Centre, Innovation, Bharat Fritz Werner (BFW)

The Dr Kalam Centre for Innovation of Bharat Fritz Werner has been playing a significant role with the clear objective of adding value to the current portfolio of BFW products and technologies since 2016. A team of about 10 research engineers, comprising doctorates and several masters and bachelors degree scientists with diverse specialisations is dedicatedly striving to achieve the common goal of technology and product enhancement. The Indian government (DSIR) recognised research centre's output in general, which is evaluated in the form of manifestations of new products, new and advanced technologies, new verticals/businesses, international paper presentations/publications, and patents.

Technical pillars of innovation

The BFW R&D's innovation theme comprises four major technical pillars:

1. Spindle
2. Structure
3. Technologies
4. Sustainability

The R&D centre has dedicated technology skills and the

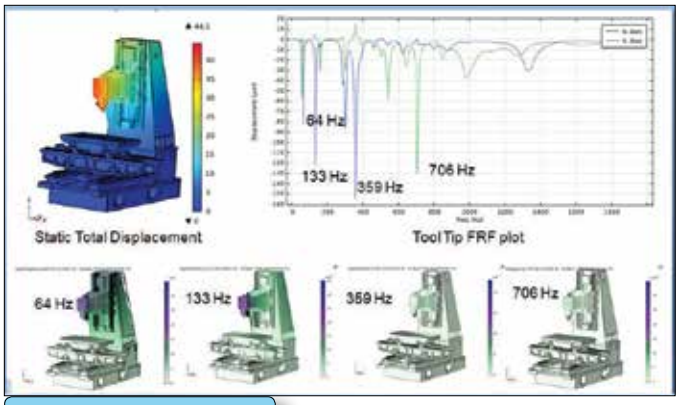


Fig 1 - Finite element based dynamic analysis of the machining centre

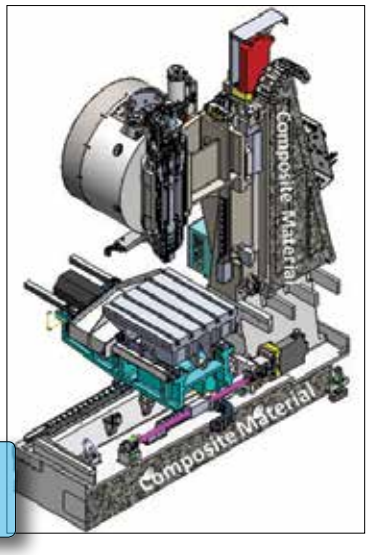


Fig 2 - A cross-sectional view of the iCTech composite technology enabled machine

resources to cater to all these technical aspects of the machine tool business. Let us discuss a technology perception in all of the above aspects of machining centre development.

Spindle

BFW categorises spindles into three major aspects based on their technology of development and usage: a widely used belt-drive spindle, a highly efficient in-line spindle, and a high-speed motorised spindle for die-mould applications. Recently, R&D has played an important role in the spindle variant reduction from 121 to the final 12 numbers of spindles based on the standardisation of spindle components and applications.

A spindle expert system has been introduced for spindle designers, where the system suggests suitable spindle combinations based on the spindle speed, torque, and power requirements. It also serves as a decision-making tool where the priority will be assigned to various dependent and independent aspects such as dynamic stiffness v/s balancing, accuracy v/s cost, low thermal effects v/s noise, etc. The expert system uses all these input data based on priority ratings and helps predict suitable drive type, bearing type, and bearing span using python-based algorithms. It ultimately saves time and reduces dependency on individual spindle experts.

An air-oil lubricated motorised spindle to realise high-speed machining (HSM) has been fabricated and is being tested for its performance at vertical as well as horizontal positions. The high-speed spindle is designed to attain spindle speeds up to 20,000 RPM from existing 10,000 RPM capabilities. A high-performance high-speed air-oil lubricated spindle has been designed for the upcoming precision series machines.

Structure

The FE analysis tool helped BFW designers optimise the existing machine designs and introduce new structural designs for the machining centers. BFW R&D follows stringent design guidelines where the 3D machine models not only go through the static analysis but also prove out in frequency-based dynamic analysis (Fig 1). Moreover, BFW could be one of the first in machine tool industries where machine performance gets predicted at its design stage during design analysis based on digital twin technology.

R&D exclusively uses the python-based algorithm where the tool-tip dynamics result in the Frequency Response Function (FRF), which further leads to the prediction of the cutting performance of the machine even before building its physical prototype. Thus, the 3D machine model dynamics, tooltip FRF, and stability lobe diagram (SLD) help predict the accurate dynamic performance of the machine at the design phase in the development of machining centres.

Technology

A disruptive 'optimum stiffness-to-weight ratio' based iCTech composite technology has been developed in-house to address present challenges faced while using existing cast iron and steel fabricated machine structures (Fig 2).

The iCTech enhances the existing static and dynamic properties of machine structures in many ways, thanks to its unique mixture formula. A comparison of an iCTech machine with an existing one has shown significantly improved stiffness and damping characteristics for machine tool structures that stand out in the crowd.

BFW R&D has developed a glass fibre reinforced epoxy granite (GFEG) vertical milling centre with an academic

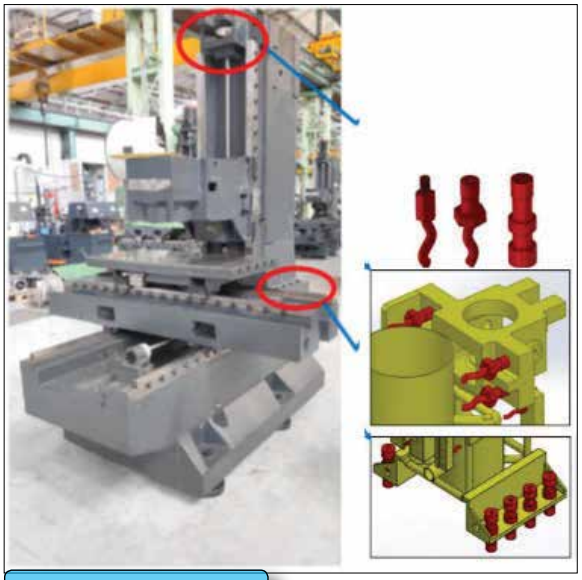


Fig 3 - GFEG made vertical milling centre

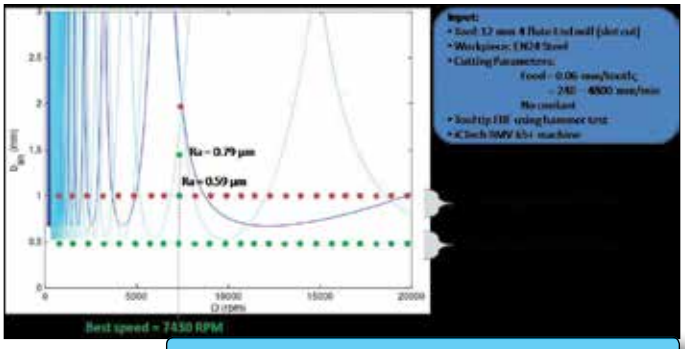


Fig 4 - Validation of stability lobe diagram (SLD) based machine performance optimisation

collaborator, PSG College of Technology, Coimbatore (Fig 3). The project has been successfully accomplished with India's first indigenously developed GFEG machine with the major funding from PSA office Govt. of India. This GFEG machine structure delivers at least a 100% improvement in productivity in terms of MRR along with higher product surface quality. BFW is looking forward to implementing this technology in the upcoming products where precision and superior part finish are the major objectives.

The machine-dynamics-based performance tool has been recently developed and is in the testing phase. This performance tool predicts the cutting performance of a typical machine even at the design phase (Fig 4). This stability lobe diagram (SLD)-based technology offers the luxury to redesign or modify the existing line of machines, considering the specific customer demands with respect to the performance of the machine. This performance tool is developed around all the necessary inputs, such as cutting tool geometry, workpiece material, processing parameters, and the dynamics of a machine, making the machine performance predictions closer to reality.

A novel intelligent real-time thermal control module (iRTC) will be a game changer while addressing all the thermal issues in the machines in the coming days. The iRTC module intelligently addresses the effects of the environment, spindle running, and spindle cooling during the cutting operation. The iRTC module is based on the physics of heat generation, and the compensation strategy is based on the partial difference method. The iRTC module is developed both for the spindle and the machine structure in order to improve the effectiveness of spindle cooling (in case of motorised spindle) and has been compared with the standard chiller control system. The iRTC module improves the part precision up to 90%. Therefore, the upcoming BFW machining centers can be expected to take care of thermal issues achieving the required part precision with the help of an optional real-time based iRTC module.

Sustainability

Finally, towards sustainable growth, foundry waste sand from BFW's Hosur-based foundry plant is innovatively transformed into lightweight construction bricks and the raw material for 3D concrete printing. The Hosur plant annually produces around 400 tonnes of foundry waste sand, which is challenging for its disposal in the environment.

However, BFW's R&D team has introduced a unique transformation methodology where the waste sand is 100% used for the manufacturing of lightweight construction bricks after post-treatment. The commercialisation of the waste sand bricks is planned for this year, and an annual income is expected from the same.

BFW believes that R&D has positively invested throughout the tough period of the pandemic during the years 2020–21, and it expects some ground-breaking technologies and features in the product line to improve customer service in the upcoming years. □

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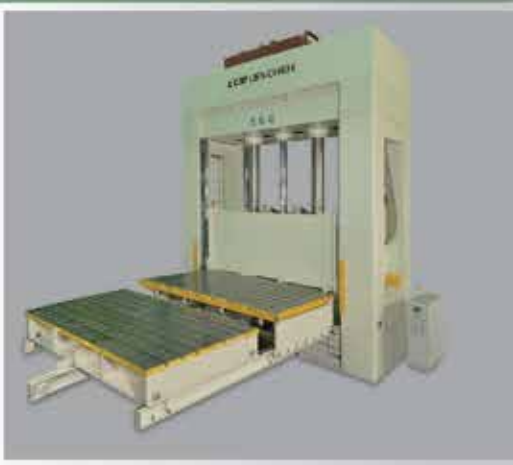

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Women climbing up the manufacturing workforce

In recent decades, a growing number of women in India have broken away from their traditional role as homemakers to join the workforce. Women have started seeking opportunities in the manufacturing industry, therefore creating a culture where women can stand shoulder-to-shoulder with their male counterparts who contribute to the growth of the company. Team EM peeks into the women workforce at Star Engineers in Chakan, Pune, in the article below.

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There was a time when we could only imagine men working on a factory floor. From building machineries to working in harsh assembly lines of shopfloors, men had been ideal candidates to perform such operations. Thanks to the gender diversity drive in India today, we see more shopfloors hosting women than before. Today, more and more manufacturing units across India are encouraging women to work on the shop floor and play an active role in manufacturing operations, thus creating a platform where women can perform at par with their male counterparts.

According to a survey by Avtar and GE, women account for 12% of India's industrial workforce. However, things are changing now, and women are making their way to the shop floors of automobile, electronics, and mining companies. Their eye for detail, drive to bring about change, precision, dexterity, work

ethic, loyalty, and lower attrition rates make them an attractive talent pool for companies, both large and small.

Diverse workforce makes the difference

Factory floors have traditionally required workers to operate heavy machinery, which requires physical strength. With time, the rapid use of automation practises has led to factories becoming more mechanised while using robots, hoists, and lifts to do heavy lifting is allowing companies to hire a more diverse workforce.

With the right training and relevant skillset, women are now inspiring a sizeable number of other women, who are jumping on the bandwagon and adding to the numbers as they are creating an impact in the right direction. With the required focus and good grasping skills, these women bring an added value to the floor, which is reflected in their work. It's also equally important to create a safe working environment where their unique strengths can thrive. As a result, proper and equitable pay, health benefits, and flexibility are critical. Offering growth irrespective of gender and upskilling opportunities is surely inspiring more women to join the manufacturing workforce. More women workforce representation, participation, and involvement are what the manufacturing industry needs to innovate and improve production capabilities and quality. Besides delivering a strong work ethic and long-term company loyalty, an all-women production floor offers another distinct advantage — superior manual dexterity necessary for high-precision electronics assembly.

Welcoming women on shop floors

Giving an equal opportunity to women and appreciating their talent on the shop floor, Star Engineers heartily welcomes women. The Chakan-based MSME engages in designing, developing, manufacturing, and supplying a wide range of automotive electronics components to the global OEMs in the two and three-wheeler segments. Their product line ranges from ignition controls, sensors, regulators and recitifiers, flashers, chargers, converters, and electronic throttles for ICE and EV segments, among others. A walk on the shop floor at the Star Engineers' factory is a visual treat of women heavily engaged with manual insertion, wave soldering machines, in-circuit testing, harness soldering, decapitation through casting, screw assembly, automatic optical inspection, testing, and potting.

According to the team, women are focused on their job at hand. While some women have been working in the factories for years, they have progressed and climbed up the ranks, moving on to bigger roles; new joinees are also equally engaged and involved in heavy-duty operations on the floor. With constant support from families and the management, these women are now dreaming big as they have earned a respected position, be it in their personal lives or professional lives. They also intend to continue working in the same field as they learn more and recommend suggestions that are implemented on the floor after necessary approvals.

Providing equal opportunities

According to Gangotri Upadhyay, a skilled operator who has worked with the company for over seven years, "Working in the manual insertion section and being a responsible part of Star Engineers gives me the pride of being a part of an amazing journey with a company that provides equal opportunities and support in every way."

"My determination and the conducive work environment at the Chakan plant have helped me at a great level. It has been seven years in this company, and I am fortunate enough to have been given opportunities and exposure that have helped me grow both personally and professionally." Training is a major boost to the women's workforce in any orgnaisation. Speaking on the same, Upadhyay added, "In my initial days, I got the required training from the company, and after that, I started working in the manual insertion department. In manual insertion, products that cannot be picked and placed by machines are inserted and placed manually onto the product. This job is quite easy and does not require any extra effort, however, proper concentration and hard work are certainly required."

Today, women have gained expertise in every aspect of factory floor operations. Sharing insights on the factory workforce, Prashant Yeole, Deputy Manager and Production Incharge, said, "There are around 450 associates on the shop floor, out of which more than 130 women are stationed on the shop floor. Some are placed in the testing and potting section, and some are placed in the manual insertion, soldering and testing, automatic optical testing, panel inspections, and in-circuit testing departments."

Speaking on the women's expertise on the shop floor, Yeole added, "These women get promoted to different departments, and they are smart in solving any kind of given problem as they are well trained as well as have the apt focus to solve complexities. Rather than addressing the issue with the machinery and

Gender diversity on shop floor

workflow, they come up with solutions, that reflect their strong will and sharp mind to work and understand the machines."

Representing women on shop floors

While interacting with Vaishali Gole, Group Leader, shared, "I have 12 years of experience with Star Engineers. My education is in ITI, and my first job with this company was in the in-circuit testing department for six years, after which I moved into other divisions. Now, after a vast in-house experience, I am the group leader. I have been working with every segment on the shop floor, and so I have hands-on experience, knowledge, and expertise of all the machinery and products." Being a proud employee, Gole stated, "Along with the technical expertise, I represent every woman on the shop floor. I look after every personal or professional issue and solve it as soon as possible. I must say that the company supports all women equally and allows them to rise higher in professional terms."

Swati Kambale, who has been with the company for eight years, shared her motivational journey."I have completed BCom and after I joined this company, I worked in manual insertion, in-circuit testing, soldering, and the testing and potting department. With every year passing by, I have been learning something new and promoting my skills, knowledge, and expertise at the outset of the company." Kambale also mentioned that she is a married woman and that her family equally supports her job. "They do not feel that it is unusual. Rather, they are proud of what I am doing. People around me, friends and other women, also feel motivated by me."

Creating an equilibrium at shop floors

Not only manufacturing enterprises but the government is also playing a crucial role by encouraging OEMs to enrol more women on the shop floor, which steps up the women's ratio on the shop floor. This not only ensures gender diversity but also encourages women from all walks of life to work on shop floors.

Jyotsana Mohate, who has been working with Star Engineers for the last five years, supports such initiatives. "Without any second thoughts, I joined this company as I knew working with the machines and learning something out of the box would have helped me progress in my professional life. I work in the testing department, where we test the product after it comes from the manual insertion, soldering, and screwing departments. This job profile requires technical knowledge. Also, I feel safe while working with other men on the shop floor, as they are quite friendly and dedicated to their work profiles," she concluded.

A visionary entrepreneur with his continuous diligent, and his strong technical academics, K Lal, Chairman, established Star Engineers in 1988. Following his legacy, Divya Ramraika, MD, with his excellent entrepreneurial skills, has set the bar for futuristic technology, QCD and customer satisfaction. "Backed by cerebral in-house R&D and global technology partners, Star creates cutting-edge technology products to suit the customer requirements. The products range from ignition controls, sensors, regulators and recitifiers, flashers, chargers, convertors, electronic throttles for the ICE and EV segments," said Ramraika.

"Star is qualified for automotive standards certified for TS16949, and ISO14000. Star consciously follows practises like 5S, TPM, Kaizen, process control and training. We believe recruiting and retaining female talent in assembly, management, and leadership roles can reap big rewards. Empowering the female workforce with tools and training is helping us, as manufacturers to unleash full potential. We also have ensured a safe working environment where their unique strengths can thrive. We strongly believe that women workforce are generally more loyal, focused better at following complex instructions, multi-tasking, and their superior manual dexterity as a necessity for high-precision electronics assembly," said Ramraika. □

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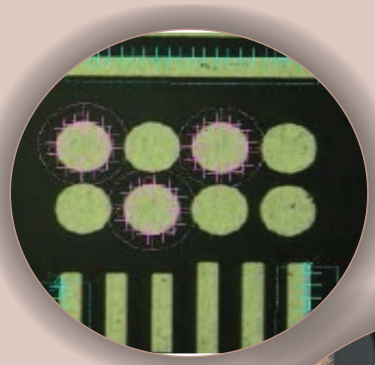

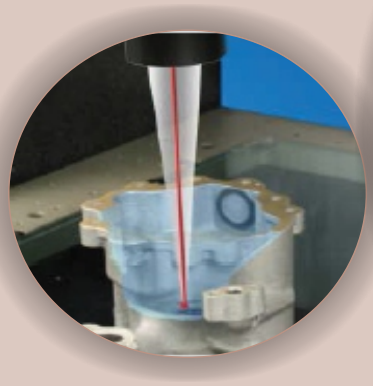

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Motion control platform

Aerotech recently expanded Automation1, which is a motion control platform. Replacing Aerotech's previous control platforms (A3200, Ensemble & Soloist), the Automation1 suite offers new, more powerful features in an easy-to-use architecture. The latest release, 2.2, builds on previous versions, but additionally impresses with features such as machine apps HMI development tool. This new and fully customisable tool replaces the previous CNC user interface and promises to revolutionise user interfaces for drive systems. In addition, Automation1 is now EtherCAT compatible, enabling connectivity to PLC based systems, thereby also expanding options for high-precision motion processes when embedded in a traditional lower precision system. Other important developments in new release 2.2 are:

Automation1

- Improved interfaces with additional Labview VIs and a Python API
- Enhancement of the Dynamic Controls Toolbox (a popular feature from the A3200 controls), which combines Aerotech's Harmonic Cancellation, Command Shaping and Cross axis Feedforward functions
- Stepper motor control with closed loop
- Asset wide backup and restore functionality using Aerotech's advanced API functionality

Aerotech Automation | Singapore
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Modularised disc stack separator

Alfa Laval has introduced AlfaPure S7 to AlfaPure range, which is a range of centrifugal separator system that removes oil, grease and solid particles from water and oil-based liquids. Continuous cleaning increases wash liquid life by 600% and extends coolant life to up to 10 years. The Alfa Laval AlfaPure S7 module is designed to clean service fluids in metal-working industries, such as vehicle manufacturing, and light industries, such as white goods, aerospace, metal components, and can manufacturing. By using high-speed centrifugal separation, it is possible to greatly extend the life of service liquids and minimise environmental impact. The disc-stack centrifuges provide fast, efficient, simultaneous three-phase separation of, for instance, water, oil and sludge. The result is lower costs due to reduced service fluid and chemical consumption, lower costs for disposal of used oil and filters, more plant uptime, and improvements in both product quality and working environment. Often installed in a bypass system, the module is operating continuously without interfering with the main process. This means, that there is no need for any type of plant re-design.

AlfaPure S7

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Screw air compressors

ELGi Equipments offers 2.2-45 kW EN series, which is a screw air compressor. This compressor series is designed to encapsulate all functional components and compressor within a common housing with its small footprint, high reliability and low maintenance requirements. Its design is compact and elegant that is filled with the company's unique assembly, which is energy efficient, has minimal pressure drop across the system, compact & silent. It has the best-in-class maintenance and operating costs & efficient air-oil separation. The optional variable speed is designed for energy efficiency. The indigenously designed Neuron XT control system offers operating data and safety measures. It also has a highly efficient belt drive transmission that ensures efficient power transmission over very long distances. This series is applicable in various industries, such as textile, food processing, paper, automotive, small machining & fabrication workshops, and so on. The series is highly reliable and has low maintenance requirements.

2.2-45 kW EN Series

Elgi Equipments | Coimbatore
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Control cabinet manufacturing

EPLAN platform recently introduced the new Eplan Smart Mounting software supports manual control cabinet assembly in a highly efficient manner. Combined with Eplan Smart Wiring, cabling can also be precisely displayed. The new software supports technicians in assembling and mounting all the components in a control cabinet and on mounting panels. Presented in a user-friendly way and supported by a 3D visualisation, the technician immediately recognises where components must be placed. Eplan Smart Mounting provides production employees a complete list of all the work steps to be carried out. It starts with the mounting of DIN rails and cable ducts and ends with electrotechnical components, including auxiliary switches and timing relays. The browser-based application with a central web server doesn't require any installation and can be used directly in the workshop, for instance on a tablet computer. Eplan Pro Panel's digital twin provides the relevant engineering information – including dimensions, positioning, drill holes and the type of fastening needed for each component. Another practical advantage is that changes to the project can now be quickly implemented.

Eplan Smart Mounting

EPLAN Software & Services | Bengaluru
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Paper-based tear tape

Essentra Tapes recently launched its paper-based tear tape, Rippatape® Halo under its ECO range of solutions, with much anticipation within the packaging industry. This solution seeks to help brands and converters across the globe meet their environmental goals while providing customers with more circular curb side recyclable packaging options. Rippatape® Halo is targeted at the e-commerce market and aims to help packaging manufacturers and brand owners alike as they seek to exceed consumers' environmental expectations. It is externally certified as recyclable, with paper achieving an A+ level via the Italian National Recyclability Standard: UNI 11743 and MC 501: 2017 criteria. With a tearing performance comparable to Rippatape® 60, Rippatape Halo does not compromise on the easy opening credentials of its plastic alternative. This is truly impressive from a product based on a single ply, specialised coated paper with no plastic films or laminates. Rippatape® Halo offers a circularly recyclable opening solution for paper and board packs, eliminating the plastic film used in standard tear tapes, and focusing on fibre recovery. Rippatape® Halo is ideal for opening paper and carton or fibreboard and is the result of over four years of painstaking lab testing and much industry expectation.

Rippatape® Halo

Essentra India | Bengaluru
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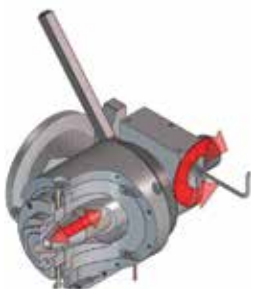
Rubber/silicon extrusion crosshead

Guill Tool has introduced the new 500 series crosshead with MAGS gum space adjustment. The 500 Series is designed specifically for the flow characteristics and unique processing challenges of elastomeric compounds. One of the key features engineered into this new crosshead design is the mechanically assisted gum space (MAGS) adjustment system. This new method of gum space adjustment allows the operator to make an effortless adjustment from a single point using a common socket wrench. The hardware-free and patent protected CAM lock design of the new series means no time is wasted unbolting and resecuring fasteners for disassembly and reassembly. The series also features the latest centre-stage concentricity adjustment system that significantly reduces pressure on the tooling, allowing easier and more precise concentricity adjustments without loosening the face bolts. Another innovative feature of this new rubber or silicon crosshead is a cast aluminium liquid-fed cooling sleeve that allows the user to switch out the cooling jacket in the event of a line obstruction, again reducing downtime compared to traditional integrated cooling systems.



Guill series 500 crosshead with MAGS adjustment

Guill Tool & Engineering | USA
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Industrial gear units

Nord Drivesystems recently widened its portfolio of MAXXDRIVE® industrial gear units with introduction of MAXXDRIVE® series. The new family member in the NORD industrial gear unit portfolio is precisely matched to the requirements of lifting equipment. The parallel arrangement of the gear stages and the thus increased centre distance were specially developed for the usual layout of lifting gear drives for cranes, where gear unit, motor and rope drum are arranged in a U-shape. The increased surface area of the XD also ensures an optimum heat dissipation. All MAXXDRIVE® industrial gear units from the company are characterised by quiet operation and a long service life. With very high output torques of up to 282,000 Nm, they are ideally suitable for demanding applications in lifting equipment, belt conveyors and bucket elevators. Precise gear geometries in the MAXXDRIVE® industrial gear units ensure excellent load capacity, long service life and low noise. High-quality, low-friction bearings and the especially torsional rigid one-piece UNICASE housing guarantee maximum robustness. The company offers its MAXXDRIVE® industrial gear units in a total of eleven sizes and in parallel or right-angle gear unit versions.

MAXXDRIVE® series

Nord Drivesystems | Pune
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Entry-level internal grinding machine

Studer recently showcased the S100 internal grinding entry-level machine, which is a machine bed made of Granitan®. It's outstanding dampening, and thermal characteristics ensure consistently good grinding results and precision. During development, special attention was given to a simple and efficient design of the components, making operation and maintenance easier for the operator. However, the equipment of the S100 also makes it suitable for grinding a universal spectrum of parts comprising geometrically defined basic forms and contours, which can be generated with interpolating axes. The machine can be equipped with up to two internal grinding spindles, or one internal and one external spindle. In addition to a fixed wheelhead, it can be equipped with manual of a 2.5-degree Hirth and, in its optimum configuration, with an automatic wheelhead with 1-degree Hirth. A synchronous motor drives the grease-lubricated internal and external belt spindles. The machine is operated by the Fanuc 0i-TF PLUS controller, together with the company's operating system. A further advantage of the S100 is the automation option. On request, it can be equipped with a loading interface and an automatic sliding door, enabling automatic operation and the production of large series.

STUDER S100

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Highlights – December 2022

» **Big Data in Manufacturing**
Big Data in manufacturing is an exceptionally large data set, potentially numbering in the billions of parameters. It can include data collected at every stage of production, including information from machines, devices, and operators. This data can be either structured or unstructured. The large volume and complexity of data sets and the number of specific tools, techniques, and best practices for working with them have led to the maturation of the field of data science and Big Data analytics in and around manufacturing. The next edition will shed light on how Big Data has been helping businesses make better decisions and how various industries have greatly benefited from adopting big data solutions.

» **Cybersecurity in Manufacturing**
Since the past few years, the global manufacturing industry has been witnessing a surge in cyber-related incidents. Cyberattacks are actively targeting the sector, with attackers specifically targeting intellectual property information. Such attacks on factories can have a crippling effect on their production capacity. The upcoming issue will dive into the issue of cybersecurity and how companies are prepared to thwart any potential risk arising thereafter.

» **AR/VR**
Augmented Reality (AR) and Virtual Reality (VR) are technologies that have transformed complex product development and production processes. VR and AR help to refine and optimise designs at an early stage. Concepts and options can be reviewed, adjusted, and modified quickly. Digital models can also be virtually tested, analysed and simulated with relevant tools. The subsequent issue explores how AR and VR technology is being adapted by manufacturers who have realised their importance.

» **Artificial Intelligence**
Artificial Intelligence (AI) is transforming the global manufacturing scenario. It promises substantial business benefits for manufacturers: increased throughput, reduced costs, and improved product quality. AI empowers machines to perform tasks that were traditionally achievable by human intelligence. By deploying the right combination of AI technologies, manufacturers can heighten efficiencies, enhance flexibility, speed up operations, and even be able to self-optimise operations. The topic gives an insight on how AI is playing a key role across product, process, and strategic levels of manufacturing.

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325-326, 3rd Floor, Sohrab Hall
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Tel: +91-7410006435/36

Subscription
Cover Price: ₹ 100
Annual Subscription Price: ₹ 1000
em.india@publish-industry.net
Tel: +91-7410006435/36

Printing
Kadam Digital Transprints Pvt Ltd,
568 B 1st Floor, A Wing,
Lokmanya Tilak Bhavan,
Next to Kesariwada,
N C Kelkar Road, Narayan Peth, Pune

Internet https://industr.com/en/

Digital edition https://www.industr.com/en/e-paper

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