EM
EFFICIENT MANUFACTURING

publish industry India

VOL 15 – Issue 06 | APRIL 2024 (Monthly) | ₹ 100

https://pi-india.in/

Diving into the Deep:

Innovations Shaping the Future of Underwater Welding

- Plastic And Rubber..... 22
- Immersive Technologies In Defence Manufacturing 33
- High Speed Machining..... 36
- Battery Swapping..... 44

Also available in China, Taiwan, Singapore, Malaysia, Thailand & Hong Kong

Y-Axis Swiss Type Machining

NEO Y AXIS SWISS

New **Y-Axis Turning and Grooving Holders** for Machining Miniature Parts on Swiss Type Machines. Suitable for Difficult-To-Cut Materials.

Bottom and Top High Pressure Coolant

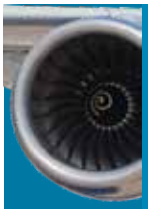
Excellent Chip Evacuation and Stable Machining

PENTACUT SWISSCUT ISOTURN

NEOLOGIQ MACHINING INTELLIGENTLY

Member IMC Group

ISCAR www.iscar.com



AEROSPACE

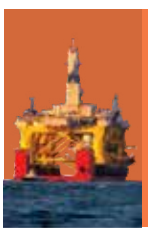
ENERGY

DEFENCE

INFRASTRUCTURE

HEALTHCARE

TEXTILE



OIL & GAS

PUMPS & VALVES

JYOTI

AUTOMOBILE

Tachyon 7
CNC High Speed Vertical Drill Tap Centre

ATM 160
CNC Inverted Vertical Spindle Turn Mill Centre

TMX 200
CNC Twin Spindle Twin Turret with Y-Axis

VTL 750
CNC Vertical Turret Lathe

HX Series
CNC Horizontal Machining Centre

HSX Series
CNC High Speed Horizontal Machining Centre

JYOTI CNC AUTOMATION LTD.
G – 506, G.I.D.C. Lodhika, Village : Metoda, Dist : Rajkot – 360021, Gujarat (INDIA).
T + 91–2827–235100/101, E info@jyoti.co.in, sales@jyoti.co.in jyoti.co.in

IO-Link – we connect you!

More functions: Smart IO-Link sensors from ifm

IO-Link devices protect against tampering, transmit the measured value as a digital value, ensure easy replacement without parameterisation on site, and are available without surcharge. You see, there are many reasons for using IO-Link sensors.
ifm as the technology leader for IO-Link offers the highest number of smart sensors with IO-Link in the market. Take the right step into an innovative future and benefit from the many years of experience which have set benchmarks in functionality and service. ifm – your IO-Link system partner. ifm – close to you!

ifm electronic India Private Limited
Plot No. P-39/1, MIDC Gokul Shirgaon · Kolhapur - 416234 · Maharashtra
Phone: +91 231 267 2770 · Fax: +91 231 267 2388 · Toll Free: 1800 233 2065
E-mail: info.india@ifm.com · Internet: www.ifm.com

"Progress through Technological Advancements"

Neha Basudkar Ghate
Joint Editor, neha.basudkar@pi-india.in

Innovations Shaping Tomorrow's World

As we delve into the fascinating developments of the Fourth Industrial Revolution, this revolution blends digital advancements with other technologies, reshaping industries and challenging our perceptions of what's possible.

Technological progress has always intrigued us, pushing boundaries we once deemed unattainable. Our cover story focuses on underwater welding—a fusion of electricity and fluid with numerous practical applications. From emergency repairs on ships to the installation of offshore structures, underwater welding plays a vital role in various industries.

Industry leaders provide insights into the progress and implications of underwater welding technology, offering a glimpse into its promising future.

Additionally, this edition of Industry Focus spotlights the Plastic and Rubber Industry, examining how they're evolving and embracing sustainability. Immersive Technologies in Defence Manufacturing and High-Speed Machining, which is the Technology Focus, take centre stage, showcasing how they enhance efficiency and revolutionise production processes.

Lastly, don't miss this edition's Special Feature on Battery Swapping Technology for E-Mobility. As the world shifts towards electric vehicles, efficient power solutions become imperative. Battery swapping offers a convenient alternative, ensuring electric vehicles remain accessible and practical for all.

Join us as we explore these groundbreaking innovations and their impact on our world. The possibilities are endless, and the future is waiting to be discovered. □

EM
EFFICIENT MANUFACTURING

Overseas Partner: Ringier
China, Taiwan, Hong Kong & South-East Asia

CONTENTS

MARKET

08 NEWS

10 **"We're poised to excel in the electric mobility arena"**
Interview with Prashant Vashisht, Chairman and Managing Director, Sokudo India

11 **"Personalising customer experience in the market"**
Interview with Mahesh Wagle, Co-Founder and Director, Cybernetik Technologies

MANAGEMENT

12 **"Collaborative leadership ensures a diverse business portfolio"**
Interview with Uday Narang, Chairman Omega Seiki Mobility

COVER STORY

16 **Diving into the Deep: Innovations Shaping the Future of Underwater Welding**
This Cover Story illuminates the vital role of underwater welders in building and maintaining crucial infrastructure beneath the waves

FOCUS

PLASTIC AND RUBBER

22 **Mould Innovations: Shaping Manufacturing's Future**
This article explores the pivotal role of plastic injection moulding and rubber moulding technologies.

MARKET

ELECTRIC MOBILITY

26 **Electrifying the future of Indian rides**
In a bid to reduce its carbon footprint, India is tackling the impending pollution issues and driving innovation

EV BATTERY

30 **EV dependence on discarded batteries**
A look into the extension of electric battery life and improving sustenance for environment-friendly solutions

TECHNOLOGY

IMMERSIVE TECHNOLOGIES IN DEFENCE MANUFACTURING

33 **The role of Autonomous Technology in Maritime Security**
Explore how immersive technology transforms defence manufacturing

33
IMMERSIVE TECHNOLOGIES IN DEFENCE MANUFACTURING
The role of Autonomous Technology in Maritime Security

44
BATTERY SWAPPING
Battery Swapping - a solution for India's E-Mobility

16
COVER STORY
Diving into the Deep: Innovations Shaping the Future of Underwater Welding

All image courtesy: *shutterstock*

36
HIGH SPEED MACHINING
Maximising Efficiency: Advancements in High-Speed Machining for job shops

HIGH SPEED MACHINING

36 **Maximising Efficiency: Advancements in High-Speed Machining for job shops**

This article explores the evolution of high-speed machining

ELECTRIC MOBILITY INDUSTRY

39 **Building towards India's e-mobile revolution**

This article delves into the infrastructure and economics of complete EV adoption that India is working towards

DIGITAL TWIN

42 **Digital Twin: The Doorway to Smart Manufacturing**

Kennametal equips manufacturers with cutting-edge tools for crafting bespoke tool path simulations and accessing the latest CNC programs

SPECIAL FEATURE

BATTERY SWAPPING

44 **Battery Swapping - a solution for India's E-Mobility**

This article throws light on India's evolving electric mobility landscape

CONSTRUCTION AND MINING EQUIPMENT

47 **A sustainable space heating solution**

Here is how PCMs are changing the field of thermal energy storage fields

NEW PRODUCTS

50 Innovative modular design with intuitive toolchain; High-performance linear motor series; Connectors for electrical safety and mechanical reliability for medical devices; High-speed phase noise analysis

51 Remote visibility of machine processes; Milling grade to maximise your productivity; Isolated power module with high efficiency; Plug-and-Play switches for industrial ethernet networks

Columns

03 Editorial
04 Content
06 Industry Edge
52 Highlights- Next Issue
52 Company Index

Neha Basudkar Ghate
Joint Editor

Technological advancements set to hold the reins!

Talk

"Industry 4.0: Where technology transforms business, paving the way for a smarter, more efficient future"

In 2023, the global industry 4.0 market was worth a huge US$ 139.8 billion. And experts predict it will reach US$ 547.1 billion by 2032, growing at a rate of 16 percent every year from 2024 to 2032. Why? Because more and more things are going digital, like the Internet of Things (IoT), Artificial Intelligence (AI), and robots. Plus, companies are spending a lot on research and development.

Industry 4.0 is changing how factories and businesses work. It's about using digital tools, like computers and robots, to make things better and faster. Machines can talk to each other, making work smoother. And because we can collect and analyse data in real time, companies can make better decisions and waste fewer resources.

Soon, about half of all jobs could be done by machines. By 2025, there could be over 50 billion devices connected to the Industrial Internet of Things (IIoT). All this technology will create a tonne of data—around 79.4 zettabytes per year. Faster internet, like 5G, will make everything even quicker, boosting the global economy by trillions of dollars by 2030.

Dr Jochen Köckler, the Chairman at Deutsche Messe, said in a report that in 2023, over 4,000 companies showed off their cool tech at the Hannover Fair in Germany. They had stuff like eco-friendly machines, new ways to use hydrogen, robots controlled by voice commands, and smart energy solutions. It's the start of a whole new way of making things!

The rise of Industry 4.0 is not just a trend; it's a revolution in how we do business and make things. With technology advancing at an unprecedented pace, the future promises even greater innovation and efficiency in every aspect of industry and manufacturing. ☐

neha.basudkar@pi-india.in

DN SOLUTIONS

SVM 4100*i*

High Productivity Swift Vertical Machining Center

- High acc/dec spindle & axis travel performance
- Optimizing structure for light material cutting and swift machining
- Reliability of Spindle and Thermal displacement

Description	Specification
Travel distance(X/Y/Z)	770/410/510 mm
Table	920 x 410 mm / Load capacity: 600 kg
Spindle	Max. speed: 10000 r/min Max. torque: 95.5(S3 15%) N·m Taper: ISO #40, 7/24 Taper
ATC	30 Tool Magazine T-T-T: 1.5s / C-T-C: 3.4s

DN Solutions India Private Limited
No.82, Jakkur Village, Yelahanka Hobli, Bengaluru, Karnataka, India-560064
info.india@dncompany.com / igor@dncompany.com
dn-solutions.com

MACHINE GREATNESS™

Recyclekaro to launch India's first Plasma Furnace Technology Unit

Recyclekaro, is poised to introduce India's first Plasma Furnace Technology Unit. Plasma Furnace Technology harnesses high-temperature plasma arcs to efficiently extract valuable metals from diverse waste streams. Unlike conventional methods that may pose environmental hazards, this technology offers a cleaner, more sustainable approach to metal extraction. Recyclekaro's cutting-edge unit, currently with a capacity of 7500 metric tonnes, retrieves precious metals like gold, silver, platinum, palladium, and rare earth metals from electronic waste and industrial residues. With the advent of the new plasma furnace, Recyclekaro's e-waste recycling capacity is set to soar nearly tenfold to 75,000 metric tonnes per year. The Plasma Furnace Technology Unit will showcase state-of-the-art machinery, ensuring cost-effective and eco-friendly operations while adhering to stringent environmental and safety protocols. This advancement promises not only economic opportunities for India but also contributes to the circular economy, job creation, and technological innovation. Recyclekaro aims to make a significant contribution to rare earth element production, with ambitions to achieve up to 1 to 1.5 MT per annum, the company shared.

Tessolve and Keysight collaborate to enhance semiconductor testing

Tessolve, has recently announced a strategic collaboration with Keysight Technologies to bolster semiconductor innovation by enhancing testing capabilities at Tessolve's newly established HSIO Lab in Bangalore. This collaboration aims to expedite time-to-market for high-speed designs while ensuring optimised performance and quality for semiconductor devices. The HSIO Lab will serve as a vital resource for semiconductor companies, offering advanced test methodologies, bench characterisation, and access to Keysight's innovative test solutions. Through this collaboration, customers will benefit from improved time-to-market, enhanced product quality, and reduced development costs. As part of the collaboration, Tessolve has invested in 70 GHz test instrumentation and collaborated with Keysight to provide cutting-edge test solutions for high-speed interfaces like LPDDR/DDR5, USB 4.0, PCIe Gen 6, and more. The collaboration will enable Tessolve to offer comprehensive validation services for a wide range of high-speed interfaces, such as PCIe, USB, DDR, and MIPI, at the newly established HSIO lab.

JBM enters east India market, deploys 200 electric buses in Odisha

JBM recently introduced ECOLIFE Electric AC buses, a significant move towards sustainable public transport. It was recently flagged off by the Chief Minister, Naveen Patnaik, in Berhampur. A total of 200 electric buses will serve Berhampur, Bhubaneswar, and Cuttack. The nine metre JBM ECOLIFE electric buses are expected to save approximately 1000 metric tonnes of CO_2 and 420,000 litres of diesel over a decade. The buses feature fast-charging lithium-ion batteries and are equipped with modern amenities like Real-Time Passenger Information Systems, emergency panic buttons, vehicle tracking, CCTV, public address systems, and advanced safety measures. Nishant Arya, Vice Chairman and MD, JBM Group, speaking on the announcement, said, "This is an important occasion for us as we enter the Eastern market and are thankful to the state government for allowing us to serve the state and its people. These electric buses are technologically advanced, safe, efficient, comfortable, and will go a long way in mitigating the city's pollution".

Cattini India inaugurates manufacturing plant in Pune

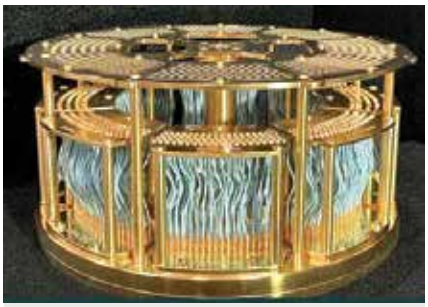
Cattini e Figlio Spa, an Italian MNC, has established a state-of-the-art manufacturing unit in Pune's Sanaswadi area. The facility, with an investment of several millions, will focus on producing various machinery products, including gears, shafts, and synchronisers. The new entity will operate under the name Cattini Power Transmission. Lorenzo Cattini, Chairman, Cattini Group, said, "This venture is expected to provide economic stability to the region". In the initial phase, the company aims for a turnover of ₹ 45 crore, with a target turnover for phase two set at ₹ 250 crore in three years. Cattini India aims to achieve a substantial turnover of ₹ 600 to ₹ 700 crore within five to seven years, the press release noted. Massimiliano Bennici, Director, Cattini Group said, "This marks Cattini's entry into the Indian market and represents a crucial step in our growth strategy to expand our presence in the Asia-Pacific region".

Suzuki and SkyDrive begin manufacturing eVTOL flying cars

Suzuki Motor Corporation and SkyDrive Inc. have started manufacturing 'flying cars' in Iwata City, Shizuoka Prefecture, Japan. The electric vertical take-off and landing (eVTOL) aircraft is characterised by electrification and a fully autonomous autopilot. It is also called Advanced Air Mobility (AAM) or Urban Air Mobility (UAM). It was in June 2023 that Suzuki and SkyDrive signed a manufacturing cooperation contract for the manufacture of Skydrive (SD-05 type) at a plant owned by the Suzuki Group in Iwata City through SkyDrive's subsidiary Sky Works Inc. and have since been cooperating towards the start of manufacturing. Tomohiro Fukuzawa, CEO, SkyDrive, said, "Partnering with Suzuki, we share a goal of quality, innovation, and customer satisfaction, making them an ideal partner in our quest to revolutionise urban air mobility". Nobuo Kishi, President, Sky Works Inc., added, "This facility allows us to produce high-quality eVTOLs efficiently and effectively, ensuring we meet the needs of our customers".

SCALINQ launches large-scale packaging solution to control Quantum devices with qubits

SCALINQ in collaboration with IQM, announces the release of LINQER600: a large-scale packaging solution capable of controlling quantum devices with hundreds of qubits. Systems of this scale have previously only existed behind the closed doors of major computing companies. With this launch, all universities and companies alike can now easily get one step closer to building large-scale quantum computing systems. The LINQER600 has undergone extensive testing to demonstrate its unrivalled functionality with Radiance, a 150-qubit chip. This successful project included both packaging and high-density filters.



The key features include: A scalable design: Offered in several variants ranging from 8 to 600 lines; **State-of-the-art performance:** Proven with different qubit chips, measuring T1 > 100us, and single-qubit gate fidelity >99.9 percent; **Host multiple chips at once:** With its modular approach, you can tailor-make PCBs to fit your needs of hosting one or several chips in one holder, and of different sizes; **Fully non-magnetic:** Carefully designed and rigorously tested in quality assurance processes.

FANUC to build Factory of the Future using NVIDIA AI platform

NVIDIA and FANUC Corporation recently announced a collaboration to implement artificial intelligence on the FANUC Intelligent Edge Link and Drive (FIELD) system to increase robotics productivity and bring new capabilities to automated factories worldwide. Adding AI to the FIELD system will give robots the ability to teach themselves to do tasks faster and more efficiently. By learning together, what used to take a single robot eight hours can now be done by eight robots in an hour. Jen-Hsun Huang, Founder and CEO, NVIDIA, said, "GPU deep learning ignited this new wave of computing where software learns and machines reason. One of the most exciting creations will be intelligent robots that can understand their environment and interact with people. NVIDIA is delighted to partner with FANUC, the world's leading industrial robot and factory automation company, to realise a future where intelligent machines accelerate the advancement of humanity".

Volvo Cars partners with Breathe for next-gen fast charging

Volvo Cars has partnered up with Breathe Battery Technologies (Breathe), becoming the first car company to get access to the latest version of its patented, algorithm-enabled charging software for use on its new-generation fully electric cars. By integrating Breathe's software into its in-house developed battery management platform, Volvo Cars aims to optimise and improve the performance of its charging technology and enable even faster charging times and an enhanced overall driving and charging experience. Volvo Cars plan to implement the new technology in its new-generation fully electric cars, where it expects to reduce the time it takes to charge the EV from 10 to 80 percent charging state by as much as 30 percent, while maintaining the same energy density and range. Ann-Sofie Ekberg, CEO, Volvo Cars Tech Fund, said, "The investment and commercial partnership with Breathe helps us address a familiar pain point for electric car customers and makes our charging performance even more competitive".

"We're poised to excel in the electric mobility arena"

…says **Prashant Vashisht,** Chairman and Managing Director, Sokudo India. In an interview with **Neha Basudkar Ghate**, he emphasises the commitment to the 'Make in India' initiative, integrating Indian craftsmanship and innovation into their electric vehicles.

How has this diverse experience shaped your vision for Sokudo India, and what unique perspectives do you bring to the table?

My journey of 25 years has equipped me with a broad perspective, enabling me to work towards addressing challenges such as range anxiety, charging infrastructure, and affordability head-on. By leveraging my background and experience in corporate management and sustainability initiatives, I aim to lead Sokudo towards a future where we set new standards in the EV market. We have also been clear about our mission of navigating and reshaping the EV landscape from the beginning, ensuring that Sokudo plays a pivotal role in India's transition to sustainable transportation.

For the 'Make in India' initiative, how does Sokudo ensure that its electric vehicles reflect the essence of Indian craftsmanship and innovation?

Sokudo's core philosophy aligns with the 'Make in India' initiative, emphasising the utilisation of Indian craftsmanship and innovation in crafting our advanced electric vehicles. By engaging with local manufacturers, suppliers, and the workforce, we ensure our products embody Indian ingenuity while supporting the economy and reducing our environmental impact. Our commitment also extends to integrating advanced technologies and sustainable materials, blending Indian values with modern design.

Could you share insights into how the collaborations with OEM players have influenced the growth trajectory and competitive edge in the EV industry?

Sokudo's partnerships with top OEMs and tech firms from Japan and Italy have been pivotal. These collaborations grant us access to advanced technology and expertise, enhancing our manufacturing processes. For instance, our Japanese partners have improved battery efficiency and durability, aligning with our vision, while our Italian counterparts have enhanced vehicle design and usability. These collaborative efforts accelerate our R&D, bolstering our performance, safety, and user experience.

Looking ahead, what are Sokudo India's key priorities and initiatives in the near future, in terms of expanding lineup, certifications, innovation?

As a high-speed scooter manufacturer, we're poised to excel in the electric mobility arena. Our immediate focus includes obtaining industry certifications such as ICAT to highlight product quality and ensure eligibility for government incentives. Innovation-wise, we prioritise AI-driven diagnostics, advanced battery technology, safety features, and efficient charging solutions. Additionally, we're enhancing manufacturing capabilities, streamlining supply chains, and improving customer service to stay ahead in India's evolving EV market. □

"Personalising customer experience in the market"

…says **Mahesh Wagle**, Co-Founder and Director, Cybernetik Technologies. In an interview with **Neha Basudkar Ghate**, he discusses the changing trends in meeting the market demands of new-age consumers in the industrial automation industry. Excerpts…

What are the significant trends currently shaping the industrial automation market, and how are you capitalising on these trends?

Further maturity in Industry 4.0 technologies will shift industrial automation towards industrial autonomy and make manufacturing increasingly data driven. Simultaneously, developments in AI will enrich human-robot interactions, leading to collaboration, or Industry 5.0. As an early entrant in the Indian industrial automation space, Cybernetik understands that appropriate digital transformation is the one change that will keep companies flexible enough to adapt to a dynamic marketplace and boost competitiveness.

With rapid technological advancements, are there specific emerging technologies impacting the industrial automation sector in the near future?

Technologies that harness the power of data and its analysis, machine-to-machine communication and autonomous decision-making, and human-machine collaboration will create the greatest impact. At the forefront are Industry 4.0 technologies, viz., Machine Learning (ML), Artificial Intelligence (AI), Industrial Internet of Things (IIoT), Virtual Reality (VR), predictive data analytics, and Augmented Reality (AR), which are making manufacturing smarter and more autonomous.

In Industrial Automation, how does Cybernetik approach risk management?

We actively collaborate with stakeholders in the industrial automation industry, for instance, we work closely with robot manufacturers, we often do joint R&D, and this helps us understand the needs, developments, and trends in the market. The combined experience, wisdom, and innovation of our teams help transform this understanding into planning in the right direction. An example of such forward thinking and action is our successful foray into the EV battery assembly segment.

Do you see sustainability becoming a more critical factor in decision-making within the industrial automation sector?

This will circle back to the changing trends of the new-age consumer. As consumers demand sustainable products, manufacturers will need to change their business models to adapt. Sourcing raw materials from sustainable sources will require significant changes in the manufacturing process, equipment, packaging, and more.
For now, Cybernetik's approach to sustainability is broad and based on resource use optimisation. All our solutions use optimal amounts of energy, water, metal, and other materials. One of our key focus areas is Cleantech, where we provide automation solutions for companies that indirectly help the environment. □

"Collaborative leadership ensures a diverse business portfolio"

… says **Uday Narang**, Chairman, Omega Seiki Mobility. In an interview with **Neha Basudkar Ghate**, he talks about the company's approach to meeting the competitive landscape, with a special focus on sustainable management practices.

Q You are known for your belief in collaborative leadership. How does this approach contribute to your success in the context of managing diverse companies within the Anglian Omega Group?

» Collaborative leadership fosters synergy among the various entities within the Anglian Omega Group. By encouraging open communication and shared goals, Omega Seiki Mobility can leverage the strengths and expertise of each company within the group, promoting a unified and cohesive business strategy. It facilitates cross-functional innovation. With diverse companies specialising in areas such as bright steel bars, sheet metal fabrication, and cold chain warehousing, Omega Seiki Mobility benefits from a wealth of expertise. This also enables efficient resource utilisation across the Anglian Omega Group.

Collaborative leadership ensures a unified vision and set of values across the Anglian Omega Group. This alignment is crucial for creating a cohesive corporate culture that extends to every facet of the business. Within the Anglian Omega Group, the collaborative leadership approach extends beyond Omega Seiki Mobility to encompass entities such as Omega Bright Steel Private Limited (OBSC), Anglian Infrastructure, Aditi Metal, and ADM. This synergy allows each company to contribute its unique capabilities to the overall group strategy, creating a harmonised and diversified business portfolio.

Q How do you strategise your management policies to address challenges in the EV business?

» We recognise the immense potential and concurrent challenges within the commercial electric vehicle market. One of the primary obstacles is the existing infrastructure gap, especially in non-urban areas, hindering the widespread adoption of electric vehicles. Additionally, the

initial cost barrier remains a concern for potential buyers, necessitating a concerted effort towards a 'Make In India' initiative to address pricing concerns.

To overcome these challenges, we have devised a comprehensive strategy. Firstly, our commitment to product innovation is evident in our diverse range of electric vehicles, including three-wheelers and electric trucks. To address the infrastructure gap, we are actively partnering with charging infrastructure providers to establish accessible charging networks, particularly in tier-two and tier-three cities. We are also forging alliances with key players in the e-commerce and logistics sectors to provide end-to-end solutions, aligning with the burgeoning demand for electric fleets. Community building is at the core of our strategy. We actively engage with stakeholders, including businesses, drivers, and government bodies, to foster education, address concerns, and create a supportive ecosystem conducive to CEV adoption.

Q How does the company strategically navigate the competitive landscape in the EV market?

» OSM strategically navigates the competitive landscape in the EV market by employing a multifaceted approach encompassing innovation, partnerships, and a customer-centric focus. At the core of OSM's strategy is a commitment to continuous product innovation.

Strategic partnerships play a pivotal role in OSM's competitive positioning. The company collaborates with key players in the e-commerce and logistics sectors to provide end-to-end solutions, addressing the growing demand for electric fleets. Additionally, international partnerships like C4V for battery cell manufacturing and Korean tech giant Jae Sung Tech for powertrain manufacturing, contribute to the local manufacturing of critical components. Financial accessibility is also a focus area for OSM, where we have collaborated with financial institutions like PNB, Axis Bank, IDFC, and Indusland Bank.

Q How is the management working towards sustainability for business success, in terms of product development and corporate operations?

» Our holistic approach positions the company at the cutting edge of India's sustainability industry, allowing it to drive positive change and contribute significantly to the evolution of the electric mobility landscape. In terms of product development, OSM's dedication to sustainability is reflected in the diverse range of electric vehicles designed to meet the evolving needs of the market.

Moreover, OSM strategically aligns its corporate operations with sustainability goals. The focus on manufacturing optimisation, including vertical integration, modular platform design, and lean manufacturing principles, not only enhances efficiency but also reduces the environmental footprint of production processes. By controlling key components such as motors, batteries, and controllers, OSM minimises dependence on external suppliers, contributing to a more sustainable supply chain. In essence, Omega Seiki Mobility integrates sustainability into its DNA, from innovative product development to streamlined corporate operations. The strategic focus on providing eco-friendly mobility solutions, optimising manufacturing processes, embracing advanced technologies, fostering inclusivity, and addressing infrastructure challenges positions OSM as a leader in sustainable practices within the electric vehicle industry.

Q Innovation, design, and safety have been the foundations of 'Full Mobility Solutions'. How is your management working towards this, and what do you foresee in the coming years?

» Research and development investments ensure that OSM remains at the forefront of technological advancements, producing a diverse range of electric vehicles that cater to various market segments. The modular platform design approach allows for adaptable and visually appealing designs, maintaining a consistent product identity while meeting customer expectations. Stringent safety standards are incorporated into the design and manufacturing processes.

Looking ahead, OSM envisions a future centred around sustainable and eco-friendly transportation solutions. The expansion of electric three-wheeler offerings and the introduction of electric trucks, aligned with competitive pricing and sustainability, demonstrate the company's commitment to addressing diverse transportation needs. Innovations like Muse, an air-conditioned passenger electric three-wheeler, showcase OSM's dedication to elevating the commuting experience through a blend of efficiency and luxury. In anticipation of 2024, there is a clear trend towards increasing EV presence in Tier 2, 3, and 4 cities. Efforts will focus on improving accessibility and charging infrastructure in these regions, fostering nationwide growth. Emerging trends in the electric vehicle industry anticipate a transformative landscape. There is a heightened focus on safety standards, design aesthetics, and fast charging technologies. The Total Cost of Ownership (TCO) model is becoming pivotal, influencing adoption decisions. As the industry converges with technology, AI, and robotics, 2024 aspirations include empowering women in the EV workforce, emphasising gender inclusivity and diversity. ☐

MITSUBISHI MATERIALS

DIA EDGE

AHX SERIES

HIGH PERFORMANCE FOR STEEL, STAINLESS STEEL AND CAST IRON MACHINING

Latest range of face mill cutters with multi corner inserts

AHX640S

AHX440S

AHX475S

AHX640W

Unique 14 Cornered Insert

MMC Hardmetal India Pvt. Ltd.
A Subsidiary of MITSUBISHI MATERIALS

Tel : +91 80 2204 3600 - 2204 3699
Website : www.mitsubishicarbide.com
Email : mmcindia@mmc.co.jp

YOUR GLOBAL CRAFTSMAN STUDIO

MOLDINO Tool Engineering, Ltd.

MOLDINO

TR4F type

Radius Mill TR4F type

Exclusive high-efficiency cutting,
resulting from unique insert and body shapes

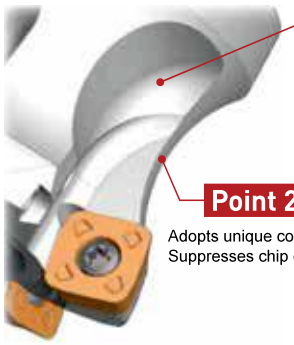
TR4F type to meet specific challenges posed by high-efficiency cutting

Issue
01

Although high-feed cutting is performed for shaping,
resulting severe chip clogging and biting may reduce shaping efficiency.

Proposed solutions

Adopts new body shape to enhance chip removal.
Suppresses chip clogging, even when cutting long overhangs.



Point 1

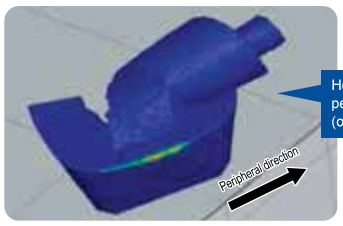
Offers excellent chip removal performance thanks to large open pocket, thereby eliminating clamp pieces.

Point 2

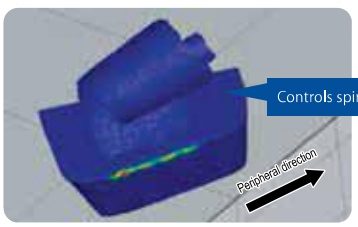
Adopts unique constricted shape.
Suppresses chip clogging between tools and wall surfaces

Point Suppresses chip clogging.

Optimizes cutting edge design to achieve smooth chip removal flow; keeps chips away from wall surfaces.
Suppresses clogging from the time chip generation starts.



Conventional



TR4F type

Breaker type is added to the inserts (1 item, 4 grades)

Lineup of holders are added. (φ32, 40, multi-flutes type total 14 item)

MMC Hardmetal India Pvt. Ltd.
A Subsidiary of MITSUBISHI MATERIALS

Tel : +91 80 2204 3600 - 2204 3699
Website : www.mitsubishicarbide.com
Email : mmcindia@mmc.co.jp

YOUR GLOBAL CRAFTSMAN STUDIO

Diving into the Deep:

Innovations Shaping the Future of Underwater Welding

Neha Basudkar Ghate
Joint Editor

Delving into the challenges and intricacies of an often-overlooked profession that melds welding expertise with underwater exploration, this Cover Story illuminates the vital role of underwater welders in building and maintaining crucial infrastructure beneath the waves.

Exploring the deep sea is like exploring another world. Construction projects like bridges and oil platforms stretch into these underwater realms, needing skilled workers to build and keep them in shape. On land, welding and construction are familiar tasks, but underwater, it's a whole new game. Welcome to the world of commercial diving, where underwater welding takes centre stage.

Underwater welding is often called one of the riskiest jobs out there, facing challenges from the environment, tools, and the welding process itself.

Many people haven't heard of underwater welding or think it's too risky. But it's surprising to learn that it's not only possible but also essential for tasks like emergency ship repairs, installing offshore structures, and building harbour facilities. This special feature dives into everything about underwater welding: the basics, different types, risks, and methods used.

The Fundamentals of Underwater Welding

Underwater welding, credited to the Russian metallurgist Konstantin Krenov in the early 1930s, remains a vital technique for maintaining and repairing submerged marine structures worldwide. Also known as hyperbaric welding, this method is conducted while the welder is submerged, typically at varying barometric pressures.

Contrary to common belief, underwater welding isn't vastly different from its land-based counterpart. Both employ similar fundamental techniques and tools. While some may imagine underwater welding to be performed directly in the water, making the welder wet, it can actually occur either underwater (referred to as wet welding) or within a dry, pressurised enclosure (known as dry welding).

Exploring Underwater Welding Techniques

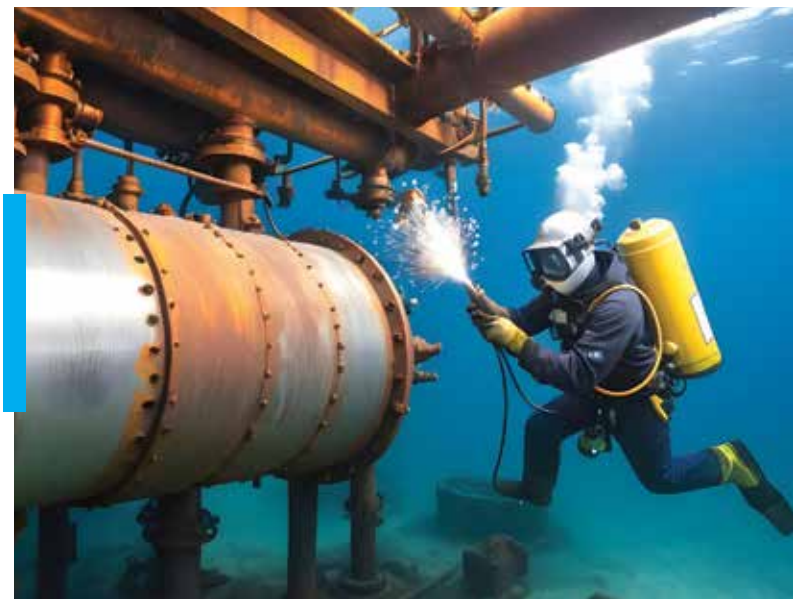
Underwater welding encompasses two primary categories: wet and dry techniques.

Wet welding involves welding directly in the water, often using specially designed welding rods. This method exposes the welder to environmental elements. While wet welding is sometimes deemed a last resort due to inherent risks, such as rapid cooling of the welded joint caused by surrounding water, it offers benefits like cost-effectiveness, rapid access to weld spots, high tensile strength, and no requirement for construction.

In contrast, dry welding utilises a hyperbaric chamber to create a dry environment. Welding is conducted within this chamber, which is filled with a gas mixture at the prevailing pressure. Unlike wet welding, this method simulates open-air conditions, although fumes and gases produced during welding impact the confined environment.

How Underwater Welding Functions

In dry welding, the targeted structure is enclosed within a hyperbaric chamber. This chamber is then filled with gas, typically a mix of oxygen and helium, to displace water and create a dry welding environment. Crucially, the chamber must be pressurised to the correct level to prevent welders from experiencing decompression sickness during their work. Yet, there are situations where welder-divers may lack access to a hyperbaric chamber or require immediate repairs. In such cases, wet welding becomes the method of choice.



Wet welding relies on the formation of air bubbles around an electric arc to shield the weld and prevent electrical conductivity through the water. While these bubbles protect the diver, they also obscure the welding area, making precise welding more challenging. Additionally, the presence of bubbles can disturb the welding pool, potentially leading to defects like cracking, and the surrounding water can cause the welded connection to cool too quickly, further increasing the risk of flaws.

Underwater welding typically employs direct current settings rather than alternating current, as they are deemed safer for welders to work with in this environment.

Industries Dependent on Underwater Welding

Underwater welding plays a pivotal role in various industries:

- **Oil and Gas:** Underwater welding is crucial for oil and gas companies to repair pipelines and offshore platforms, ensuring the integrity and functionality of their infrastructure.

- **Maritime and Salvage:** Shipyards and salvagers rely on underwater welding for tasks such as salvaging sunken ships and conducting repairs and maintenance on vessels, docks, and other maritime structures.
- **Shipbuilding and Repair:** The Shipbuilding and repair industries utilise underwater welding for building and repairing ships, making it an essential technique in maintaining the maritime fleet.
- **Nuclear Power:** Nuclear power plants require underwater welders to perform repairs on reactor components, ensuring the safe and efficient operation of nuclear facilities.
- **Military Operations:** Military personnel utilise underwater welding for maintaining and repairing submarines, underwater devices, and other naval assets, enhancing the operational readiness of naval fleets.
- **Infrastructure Repair:** Repair companies employ underwater welding for repairing critical infrastructure such as dams, bridges, and underwater pipelines, addressing structural defects, and ensuring public safety.

Image: www.canadianmetalworking.com

Equipment and Technology in Underwater Welding

Underwater welding operations rely on specialised equipment tailored to the challenging underwater environment:

- **Welding Rods:** Specially coated rods engineered to function effectively in the presence of water, facilitating the welding process underwater.
- **Welding Machines:** Specifically designed to operate safely and efficiently in wet conditions, these machines provide the controlled electrical currents necessary for welding underwater.
- **Hyperbaric Chambers:** Essential for dry welding, hyperbaric chambers are intricate structures that create a dry and pressurised environment conducive to achieving high-quality welds. These chambers ensure welder safety and the integrity of the welding process.

Challenges Faced in Underwater Welding

In wet welding, Shielded Metal Arc Welding (SMAW) and specially coated electrodes are employed. However, visibility poses the greatest hurdle. Murky water, limited light, and floating particulates hinder visibility, making it challenging to maintain a clear view of the welding arc and puddle. Welder divers contend with obscured views inside their helmets due to exhalation and welding-generated air bubbles. Even if they manage to find a favourable position to minimise bubble interference, the constant cooling effect of water makes it difficult to observe the welding process. This, coupled with the limited puddle to monitor, makes achieving consistent and aesthetically pleasing welds underwater significantly more arduous than on land.

Hazards Associated with Underwater Welding

Underwater welders face a multitude of hazards in the dark, pressurised underwater environment, with potential injuries ranging from long-term health issues to fatalities. Risks include electric shocks, explosions, exposure to hazardous materials, and drowning.

Electric shocks, explosions, and electrocution loom as significant threats, necessitating the use of waterproof tools and protective equipment. Hazardous materials like lead and the risks of debris further compound the dangers. Excessive nitrogen absorption can lead to decompression sickness, while inadequate equipment or tools may result in hypothermia due to the extreme coldness underwater. Drowning is also a possibility in event of equipment failures, exacerbated by the challenging escape routes within the underwater environment, which could trap the diver or welder.

Advancements in Underwater Welding Technology

The future of underwater welding is poised for remarkable

UNDERWATER WELDING EQUIPMENT MARKET OVERVIEW

- The increasing need to maintain and repair underwater structures, such as offshore platforms, pipelines, and ship hulls, fuels the demand for efficient and reliable underwater welding equipment.
- The expanding offshore energy industry and ongoing infrastructure development projects contribute significantly to the market's growth.
- The versatility of underwater welding equipment in addressing diverse challenges and advancements in technology enhancing equipment performance and safety further accelerate market expansion.
- The market for underwater welding equipment is expected to experience substantial growth due to increased investments in offshore projects and underwater maintenance.

INDIA'S UNDERWATER WELDING EQUIPMENT MARKET

CAGR of 6.6% during the assessment period

Expected market valuation US$ 247.5 million by 2034

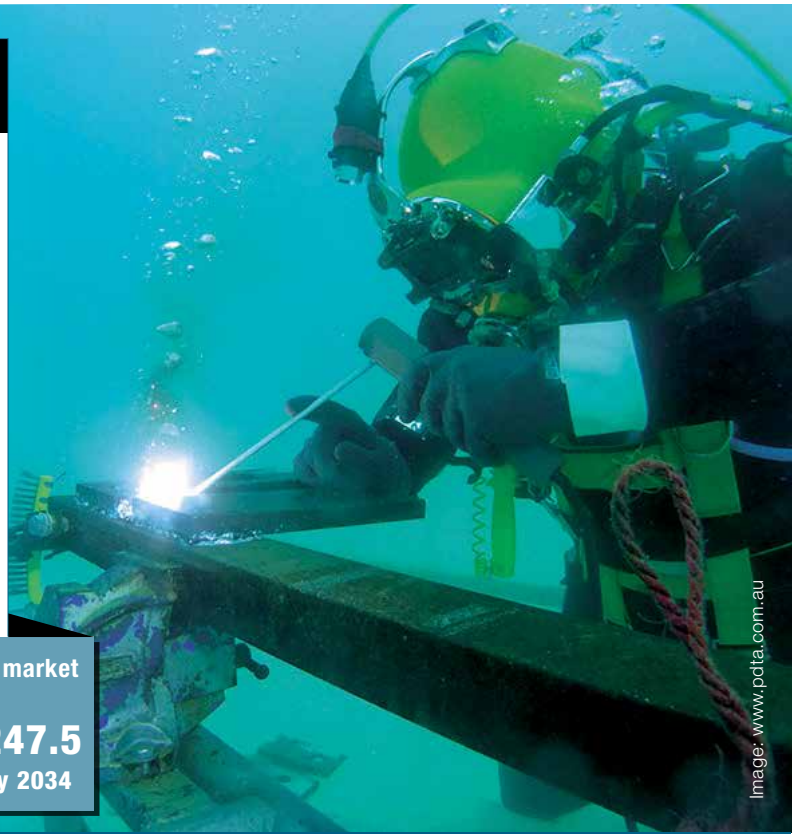


Image: www.pdta.com.au

Attributes	Key Insights
Underwater Welding Equipment Market Size in 2023	US$ 1,674.4 million
Estimated Underwater Welding Equipment Market Value (2024)	US$ 1,763.2 million
Projected Market Revenue (2034)	US$ 2,955.2 million
Value-based CAGR (2024 to 2034)	5.3 percent

www.futuremarketinsights.com

advancements, driven by a convergence of innovative techniques and cutting-edge equipment. Anticipated developments encompass a spectrum of improvements spanning equipment refinement, technique innovation, and power supply enhancement. Notably, the emergence of dry welding, which establishes a controlled, dry environment around the welding zone, promises heightened efficiency, precision, and safety compared to conventional wet welding methods. Alongside, strides in helmet technology, communication systems, and protective gear are aimed at surmounting the unique challenges encountered by underwater welders, fostering a more conducive working milieu. Moreover, the evolution of specialised underwater electrode holders and innovative power supply technologies is set to amplify the versatility, efficiency, and dependability of underwater welding endeavours.

In parallel, research institutions are poised to assume a pivotal role in propelling these advancements forward, with a concerted emphasis on refining performance metrics and devising tailored control strategies attuned to the nuances of underwater welding.

Foreseen trends underscore a paradigm shift towards automation and inspection, with an emphasis on mechanised welding techniques to facilitate the construction and maintenance of expansive floating structures, catering to the burgeoning demands of industries like offshore energy and marine infrastructure. Collectively, these anticipated trends herald a new epoch in underwater welding technology characterised by heightened efficiency, reliability, and sustainability, laying the groundwork for safer and more efficacious underwater construction and maintenance endeavours.

To delve deeper into the predictions for the evolution of underwater welding technology and its implications across industries, we turn to insights provided by two esteemed industry experts. They offer nuanced perspectives on the anticipated trends and breakthroughs poised to significantly influence the trajectory of underwater welding technology.

Sunando Kumar Palit,

Head - Strategy and Customer Experience,
Ador Welding

Underwater welding is set to undergo significant advancements, particularly in the adoption of innovative processes like friction welding using the friction stir method and laser welding. These methods are becoming increasingly automated, and seamlessly integrated with dedicated robot cells. This automation not only enhances efficiency but also mitigates the risks associated with manual welding at significant water depths, such as those encountered during deep-sea submarine repairs. Leading the charge in this field will be companies specialising in friction stir process equipment and consumables, as well as those involved in laser welding equipment and the manufacturing of industrial heavy-duty multi-axis robots used in dedicated robot cells. Moreover, research organisations will play a crucial role in advancing these processes further, focusing on improving performance and developing control strategies tailored to underwater welding.

Expected trends that will shape the future of Underwater Welding Technology

Automation and Inspection: Future developments will prioritise automating the underwater joining process and inspecting welded structures. This includes the integration of advanced robotic systems to streamline operations and ensure the quality of welds in challenging underwater environments.

Mechanised Welding for Large Structures: There is a growing need for such welding techniques to facilitate the construction and maintenance of vast floating structures. This trend reflects the increasing demand for efficient solutions in industries such as offshore energy and marine infrastructure. Overall, these new trends and advancements are going to push underwater welding technology into a fresh era marked by better efficiency, reliability, and sustainability. This progress is laying the groundwork for safer and more efficient underwater construction and maintenance endeavours.

Vishwanath Kamath

Managing Director, Fronius India

The future of underwater welding is expected to be characterised by advances in welding equipment, techniques, and power supply systems. Dry welding, where a dry environment is created around the welding zone, is gaining traction as it offers greater efficiency, precision, and safety compared to traditional wet welding. In addition, developments in helmets, communication systems, and protective equipment are aimed at overcoming the challenges faced by underwater welders and creating a more favourable working environment. In addition, innovative power supply technology with specialised underwater electrode holders will increasingly improve the versatility, efficiency, and reliability of underwater welding operations. It is expected that these advances will contribute to a wider application of underwater welding in various industries. When it comes to challenging conditions, the Fronius Ignis 180 is a lightweight and portable MMA welding power source designed for on-site welding applications. It is particularly well suited for use in harsh environments, such as construction sites, due to its robust design and ability to handle long power cables and voltage fluctuations.The Ignis 180 has several user-friendly functions, including Hot Start, Soft Start and Anti-Stick, which improve the stability of the arc and prevent the electrode from sticking. It is also available in different country-specific versions to accommodate different mains voltages.

Collectively, these insights illuminate the far-reaching implications of anticipated advancements in underwater welding technology across various industries. With each stride forward, we move closer to realising a future where underwater welding not only meets but exceeds current standards. Embracing these innovations heralds a transformative era, where the depths of our oceans become not just a challenge, but a realm of boundless opportunity and advancement. ❐

PMT MACHINES LIMITED

Where SUCCESS is a way of life...

CNC Turning Center 5000 ABC with C/Y axis & live tools

CNC Internal Grinding

CNC Cylindrical Grinding

CNC Vertical Turning Lathe

CNC Gear Hobbing

PRODUCTS

- HEAVY DUTY CNC TURNING MACHINES
- CNC VERTICAL TURNING MACHINES
- ID GRINDING
- OD GRINDING
- GRINDING CHUCKS
- SURFACE GRINDING
- HOBBING MACHINES
- SHAPING MACHINES
- FIXTURES

Tel. No.- +91 98600 78552 | E-mail - marketing@pmtmachines.com
Tel. No.- +91 96625 03927 | E-mail - mkt.brd@pmtmachines.com

www.pmtmachines.com

Pic: www.coextrudedplastics.com

Mould Innovations:
Shaping Manufacturing's Future

Plastic injection moulding and rubber moulding technologies are notably pivotal in propelling progress and fostering innovation across various sectors. These adaptable processes empower companies to craft bespoke solutions finely tuned to their unique requirements. As industries evolve and demands surge, the significance of moulding in reshaping production methodologies and confronting future challenges becomes more pronounced.

Shishir Gupta,
CEO, Riot Labz

In the fabric of 21st century society, essential inventions in automobiles, computers, electronics consumer goods, aerospace, and healthcare technology stand as pillars of progress. Yet, behind the scenes, the advancement of manufacturing processes, notably plastic injection moulding and rubber moulding, plays an equally critical role in bringing these innovations to life. With their evolution, these moulding technologies have not just boosted production efficiency but have also facilitated the creation of intricate designs and durable products, remarkably simplifying everyday life.

It's imperative to recognise that the growth and advancement of other industries are intricately linked to the progress made within the mould industry. Projections indicate substantial growth prospects for both the plastic injection moulding and rubber moulding markets. The plastic injection moulding market, valued at USD $ 175.02 billion in 2021, is anticipated to experience significant expansion, potentially exceeding USD $ 266.1 billion by 2030, with a notable Compound Annual Growth Rate (CAGR) of 4.8 percent from 2021 to 2030. Similarly, the rubber moulding market is forecast to witness remarkable growth, with projections suggesting its value could rise to US $ 54.2 billion by 2024 and soar to US$ 109.3 billion by 2034, driven by a robust CAGR of 7.3 percent during the forecast period. As plastic injection moulding and rubber moulding continue to innovate and broaden their capabilities, they serve as catalysts for advancements across various sectors, fostering innovation, driving economic growth, and contributing to societal progress.

What exactly is Moulding?

Moulding involves the manipulation of rubber, plastic, or silicone compounds through a process that enables them to assume various shapes and forms. Often, these compounds may consist of a combination of two or all three elements, offering a wide array of possibilities. The primary objective of moulding is typically to create a seal or barrier with the flexibility to expand or contract while retaining its original shape. Alternatively, it may aim to produce rigid and durable parts with specific characteristics tailored to meet particular specifications. In elastomer moulding, uncured rubber serves as the starting material, typically undergoing vulcanization processes involving heat. This transforms the rubber into a thermoset material, where two components are fused irreversibly. While rubbers and elastomers originate from natural sources, they are refined into synthetic materials through various processes and the addition of formula additives. Silicone, derived from quartz sand, serves as the fundamental raw material in moulding. Its abundant availability and adaptable chemical structure allow for versatile processing methods, often in conjunction with thermoplastics and metals. Silicone is prized for its water-repelling properties and heat resistance, with some formulations being proprietary or patented.

Moulding—a cross-industry essential

Rubber and plastic moulding serves as indispensable tools across an extensive array of industries, including aerospace, agriculture, architecture, automotive, consumer goods, construction, dental, electrical, electronics, energy and power generation, engineering, entertainment, food service, grocers, manufacturing, medical, military, plumbing, printing, publishing, retail, toys and games, and more. From crafting precision components for electronic applications to producing durable consumer goods and facilitating medical innovations, moulding technologies play a crucial role in driving progress and innovation across diverse sectors. These versatile processes enable companies to create customised solutions tailored to their specific needs. As industries evolve and demand grows, the role of moulding in revolutionising production processes and meeting the challenges of tomorrow becomes increasingly apparent.

Evolution of Plastic and Rubber Moulding techniques

- Injection Moulding: Recent advancements in this method involve the integration of robotics and automation, enhancing precision and accelerating production speeds.
- **Blow Moulding:** Widely employed in the manufacture of hollow plastic items like bottles and containers, blow moulding has witnessed notable innovations. These advancements focus on bolstering energy efficiency and material utilisation, thereby contributing to sustainability initiatives.

- **Compression Moulding:** As compression moulding remains a staple technique, the ongoing developments in this field concentrate on refining cycle times and minimising material waste through sophisticated process control systems.
- **Transfer Moulding:** Merging the benefits of injection and compression moulding, transfer moulding offers versatility in design and material selection. Recent progress aims at streamlining the transfer process to reduce production downtime and enhance efficiency.
- **Additive Manufacturing:** Also known as 3D printing, additive manufacturing this technique enables rapid prototyping and customisation, allowing manufacturers to respond swiftly to market demands.

Materials Innovation

- **Bioplastics:** Bioplastics derived from sources such as corn starch and sugarcane offer a sustainable alternative to traditional petroleum-based plastics.
- **Thermoplastic Elastomers (TPEs):** TPEs combine the flexibility of rubber with the processability of plastics, making them ideal for applications requiring elasticity and durability. Recent developments focus on enhancing the mechanical properties and heat resistance of TPEs for broader use in the automotive and industrial sectors.
- **Liquid Silicone Rubber (LSR):** LSR is gaining popularity in the medical and consumer electronics industries due to its biocompatibility and excellent electrical insulation properties. Innovations in LSR moulding techniques aim to improve part consistency and reduce manufacturing costs.
- **Recycled Materials:** Recycling technologies have advanced significantly, enabling the incorporation of recycled plastics and rubbers into new products without sacrificing quality.

Smart Moulding Technologies

- **Sensor Integration:** Smart moulds equipped with sensors and monitoring systems enable real-time data collection during the moulding process. This data-driven approach allows manufacturers to optimise parameters such as temperature, pressure, and cycle time for improved product quality and efficiency.
- **Predictive Maintenance:** Through the utilisation of artificial intelligence and machine learning algorithms, predictive maintenance systems anticipate equipment failures and schedule maintenance proactively. This forward-thinking approach minimises production disruptions and maximises productivity by preemptively avoiding unplanned downtime.
- **Digital Twins:** Digital twin technology generates virtual replicas of physical moulds, facilitating simulations and optimisations before actual production. This capability for virtual testing significantly reduces the time and cost associated with trial-and-error iterations, thereby expediting the product development cycle.

Environmental Sustainability

- **Circular Economy Initiatives:** Manufacturers are implementing closed-loop systems to minimise waste generation and prolong the lifespan of materials, contributing to a more sustainable manufacturing ecosystem.
- **Eco-friendly Processes:** Sustainable manufacturing practices, including lean production and eco-design, are gaining traction throughout the industry, fostering a commitment to environmental stewardship and resource conservation.

Conclusion

Plastic and rubber mould developments continue to evolve, driven by a combination of technological innovation, material science advancements, and sustainability imperatives. From enhanced moulding techniques to smart manufacturing technologies, the future promises greater efficiency, versatility, and environmental responsibility. By embracing these advancements, manufacturers can stay competitive in a rapidly changing global market while contributing to a more sustainable and resilient manufacturing ecosystem. ☐

EMUGE FRANKEN

Engineered
in Germany
Made in India

FRANKEN Turbine

End Mills for the Turbine and Mould Making Industry

Cutting material and coating are designed for difficult-to-machine materials such as titanium alloys or Inconel. The special geometry enables excellent accessibility for machining impellers and turbine blades. The combination of roughing with pre-finishing and subsequent finishing reduces machining times by up to 50 %.

The precision collet holder FPC guarantees the highest clamping force and excellent concentricity.

More information:
www.emuge-franken.in

EMUGE-FRANKEN India Pvt. Ltd.

Gat No. 91, 92, 93 & 128, At Post Kondhanpur,
Taluka - Haveli, Pune - 412205, Maharashtra · INDIA
+91-20-35013100 / +91-9552562501 / +91-9552562503
marketing@emuge-franken.in · www.emuge-franken.in

Electrifying the future of Indian rides

India, one of the world's most populous countries, faces dual challenge of meeting its growing transportation needs while reducing its carbon footprint. Being one of the fastest-growing economies in the world, here is how India also stands responsible for taking lead in tackling the impending pollution issues and driving innovation.

Kumar Abhishek,
COO,
BattRE Electric Mobility

Amidst surging pollution and the need for sustainable solutions, electric two-wheelers have emerged as a transformative force capturing the attention of manufacturers, consumers and policymakers alike to take a significant step towards a greener and cleaner future. Over the last few years, electric two-wheelers (e-bikes and e-scooters) have emerged as a popular choice in the Indian market due to their affordability, efficiency and ability to ease congestion in urban areas. Furthermore, leveraging the power of Artificial Intelligence (AI), the Internet of Things (IoT) and Telematics, the Indian electric two-wheeler market is witnessing remarkable growth, fostering economic development and environmental sustainability in the same ride.

Several domestic and international Electric Vehicle (EV) manufacturers have entered the Indian market, offering a diverse range of electric two-wheelers at competitive prices. The Indian government has been proactive in promoting electric mobility through various incentives and policies. To accelerate the growth of electric two-wheelers, several states offer subsidies, reduced taxes and easier registration processes. To further enhance this growth, the Indian government, in collaboration with private players, has been actively working towards building a robust charging infrastructure across the country reducing range anxiety and making EVs a more viable option for consumers.

Contrary to popular beliefs, the cost of ownership of an EV is substantially less than ICE vehicles. Despite the higher initial cost due to expensive battery technology, electric two-wheelers surpass their ICE counterparts in long-term cost efficiency. The considerably lower operating costs of EVs make them more energy-efficient and economical. While ICE two-wheelers run at over ~3 ₹/km, EVs cost ~0.30 ₹/km. As fuel rates continue to rise, this disparity will only grow. Additionally, EVs boast simplified mechanics with fewer moving parts, leading to substantial savings in maintenance and part replacement expenses. Advanced battery technology ensures that EV batteries have a smooth run for at least five years, making the ownership cost of electric two-wheelers more competitive compared to its conventional counterparts.

Smart technological advancements

The future of electric two-wheelers is intertwined with smart technologies that are reshaping the landscape of two-wheeler transportation, making it more sustainable, efficient and user-friendly. The incorporation of these advanced technologies will enhance the capabilities of the EVs with advanced safety features, predictive maintenance capabilities, personalised rider assistance and energy optimisation. Here are some ways how smart technologies are poised to revolutionise urban mobility and make EV rides smarter in the future:

- **AI-driven range optimisation:** One of the primary concerns for electric two-wheelers today is their limited range. However, AI and ML are addressing this limitation. The use of advanced algorithms can analyse various factors, including road conditions, traffic patterns, rider behaviour and weather conditions to optimise the vehicle's range. By providing intelligent range estimations and suggesting energy-efficient routes, AI enhances the overall riding experience and reduces range anxiety.

- **IoT-enabled Predictive Maintenance:** The growth of electric two-wheelers is surrounded by various concerns like overheated batteries, circuit malfunctions and more. However, IoT technology is transforming the entire maintenance landscape for electric two-wheelers. Sensors embedded throughout the vehicle continuously monitor crucial components, such as batteries, motors and brakes. AI-driven predictive maintenance systems analyse real-time data from sensors and components to predict potential failures and schedule maintenance proactively, reducing downtime and maintenance costs. Proactive maintenance alerts ensure that riders can address potential issues before they escalate, enhancing safety.

- **Connected telematics:** Telematics, a technology combining telecommunications and informatics, plays a vital role in the evolution of electric two-wheelers, enabling seamless communication between the vehicle, rider and external infrastructure.

Through cloud connectivity, real-time data such as vehicle diagnostics and battery health can be accessed through smartphone applications or in-built displays. Additionally, telematics enables features like stolen vehicle tracking and remote diagnostics, enhancing vehicle security and functionality. This information is invaluable for manufacturers to gather feedback and improve vehicle performance continually. Telematics can also enable communication between electric two-wheelers and charging stations, optimising charging schedules and thus promoting efficient energy utilisation. Furthermore, with insights into rider behaviour, such as speeding or sudden braking, telematics systems can enable riders to adopt safer practices.

Developing robust battery technology

Battery is the heart of any EV. Thus, battery technology is a critical component that directly affects an EV's performance, range and cost. Today, most electric two-wheelers use Lithium-ion (Li-ion) batteries, which offer a good balance of energy density, power output and lifespan. Li-ion batteries have become the standard in the EV industry due to their efficiency and reliability. These batteries are commonly found in various chemistries, some of the prevalent ones are Lithium Iron Phosphate (LiFePO4), Lithium Nickel Manganese Cobalt Oxide (NMC) and Lithium Nickel Cobalt Aluminum Oxide (NCA). While Li-ion batteries dominate the market, ongoing research and development efforts are constantly improving the battery technology in terms of energy density, charging speed and cost reduction. Some technologies that hold the potential to redefine battery manufacturing are:

Furthermore, amalgamating smart technologies with battery manufacturing is crucial in optimising its performance. Through continuous monitoring and data analysis, these technologies help identify patterns and fine-tune battery charging and discharging cycles, prolonging battery life and enhancing overall efficiency. Here, Battery Management Systems (BMS) play a crucial role in monitoring and managing the health of batteries in EVs. It ensures optimal temperature regulations and protects against over-voltage, overcharging, over-discharging and short-circuits. An efficient BMS is vital to extend the battery life, improve safety and enhance overall vehicle performance.

With a growing impetus towards developing battery technology, several academic institutions, research centres and private companies in India are working on improving battery performance, manufacturing and cost-effectiveness. Joint ventures and alliances between EV and battery manufacturers will further boost the research activities in this area and encourage domestic battery production in the country. Continuous advancements in battery technology will also reduce the cost of batteries thus increasing the affordability of electric two-wheelers.

The ride forward

The rise of electric two-wheelers in India, powered by smart technologies, is not only transforming the transportation landscape but also contributing to economic growth and environmental sustainability. As India is striving towards Net Zero carbon emission, electric two-wheelers are likely to become a part of a larger ecosystem to reduce carbon footprints. By embracing innovation and sustainability, the electric two-wheeler market is poised to play a pivotal role in shaping India's future mobility ecosystem. ❐

Platform 3 – The ideal basis

New development in a class of its own

JUNKER opens up far-reaching options for the future with the new development of Platform 3. With ever more productive grinding concepts, JUNKER offers the perfect solution for permanently increasing demands on costeffectiveness and precision. The Platform 3 was developed and designed precisely for this purpose.

Celebrate the world premiere from May 14 to 17 at GrindingHub 2024 in Stuttgart, Germany and experience our new developments live at our booth.

GRINDING HUB

Hall 10
Booth B50

JUNKER partner for precision

LTA

Zema

www.junker-group.com

EV dependence on discarded batteries

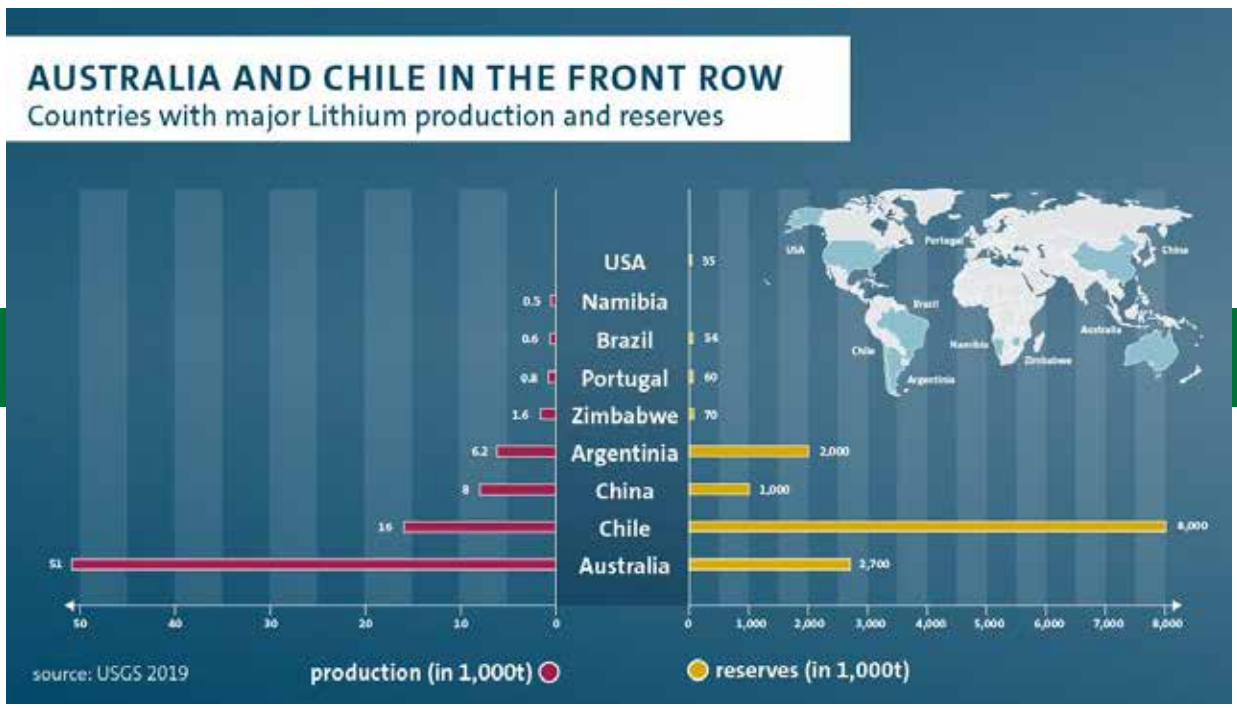
Transitioning to electrified mobility solutions relies on the development of innovative technological solutions. Here is a look into the extension of electric battery life and improving sustenance for environment-friendly solutions.

Saurav Goyal,
Co-Founder & COO,
Metastable Materials

In a bid to reverse the effects of climate change, many nations worldwide are now making significant strides towards accomplishing their goals. India has also committed to achieving the goal of 'Net Zero' carbon emissions by 2070. To achieve that, the country is placing a greater emphasis on adopting lifestyle changes that promote sustainability, transitioning to renewable energy sources and rapidly electrifying its transportation system.

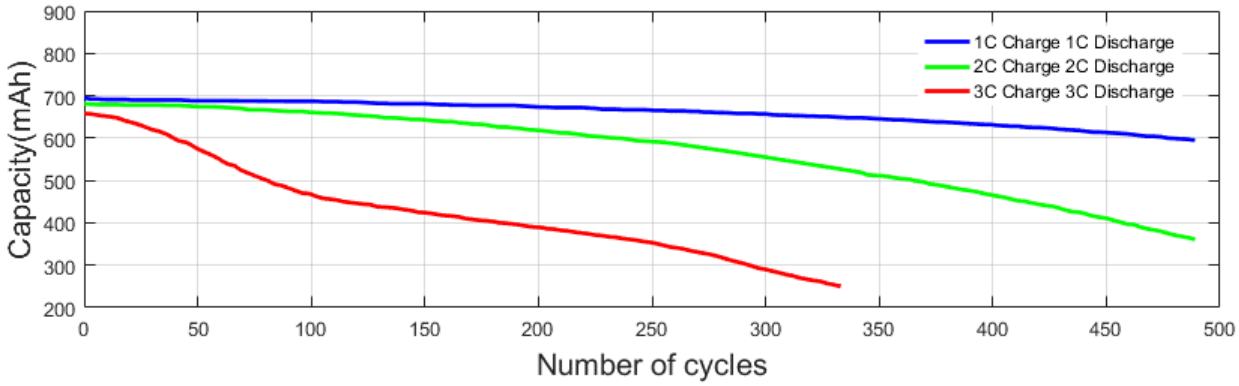
One of the leading innovations on this front is the lithium-ion battery that can store energy for extended periods for various applications, including stationary energy storage from renewable sources such as solar and wind and electrifying the entire transportation industry. The need to reduce greenhouse gas emissions has driven the Electric Vehicles (EVs) industry to gain significant traction in recent years. EVs have proven to be a promising alternative to conventional internal combustion engines. However, the lithium-ion batteries that are powering the transition away from fossil fuels have their own set of problems, the most prominent of which is the lack of sustainable raw material sourcing and management of discarded batteries.

To understand the depth of the problem, it is crucial to recognise the composition and lifecycle of these batteries first. Most lithium-ion batteries today consist of valuable metals, such as lithium, cobalt and nickel, along with copper, aluminium and several other materials that are crucial for the energy storage capacity and overall performance of EVs. Yet, they are not abundantly available in nature and are managed by a handful of nations. For example, even though Australia and Chile lead in global lithium production and natural reserves, China controls more than 60% of the value chain with its extensive refining facilities that turn the lithium produced by Australia and Chile into usable forms. While India's 5.9 million tonnes of lithium deposits may account for 5.7 percent of global reserves, commercial usage is still several years away. Until then, India must rely on imports of critical materials to establish its capabilities in cell manufacturing.



Source: https://www.volkswagenag.com

Moreover, lithium-ion batteries do not have an indefinite lifecycle and eventually degrade over time. When batteries can no longer provide adequate power or range for electric vehicles, they are said to have reached their 'end-of-life'. The typical industry standard for discarding a battery is a 20 percent decline in the energy storage capacity of a cell or battery pack, though this number is improving as a result of recent technological advances in battery design and heat management systems. Nonetheless, these discarded batteries contain valuable raw materials that can be extracted and reused. The extraction of these materials from discarded batteries serves a dual purpose: it facilitates the recycling and reuse of valuable resources and minimises the environmental impact associated with the production of new batteries.



The capacity of a lithium-ion cells to hold energy degrades over time.
Source: https://www.researchgate.net

The material extraction process typically involves several steps. At first, the discarded batteries must be collected and transported to recycling facilities, where they undergo dismantling. Subsequently, specialised techniques like hydrometallurgy, pyrometallurgy or Integrated Carbothermal Reduction™ are employed to extract and recover valuable elements such as lithium, cobalt and nickel. These extracted materials can then be reused to produce new batteries or other applications, reducing the demand for freshly mined metals and promoting resource efficiency.

The dependence of the EV industry on the extraction of raw materials, and the overall recycling industry is multifaceted. Firstly, it ensures a steady supply of critical materials required for the production of new batteries. The need for battery production is rising along with the demand for electric vehicles. The industry's reliance on primary mining, along with the associated negative environmental and social impacts, can be reduced if the industry were to begin salvaging and reusing the materials from used and discarded batteries.

Secondly, the extraction of raw materials from discarded batteries fosters a circular economy approach, where resources are recycled and reused instead of being discarded as waste. This aligns with the more comprehensive sustainability goals of the Electric Vehicle (EV) industry and contributes to the reduction of carbon emissions as well as the preservation of natural resources. By integrating recycled materials into new batteries, the industry can minimise the overall environmental footprint of EVs.

However, despite its potential benefits, the ability of the recycling industry to replace mining as the primary source of raw materials and the extraction of materials from discarded batteries poses some challenges. One of the biggest challenges is the fact that we have not mined nearly enough lithium, cobalt and nickel to realise our goal of fully electrifying all automobiles, developing storage for renewable energies and other applications of lithium-ion batteries. For instance, 54,000 EVs were placed on the market in the US in 2012, with a combined cell weight of 5,500 metric tonnes. In 2027, 3.8 million vehicles are expected to be sold in the US, with a combined weight of 1.3 million metric tonnes. Hence, even if 100 percent of the batteries from 2012 are recycled, they will represent less than 0.5 percent of the need in 2027 in the US alone.

The development of reliable recycling technologies that are efficient and will not break the bank is another obstacle. Recycling batteries is a complex process that requires specialised facilities and equipment. Developing and scaling up recycling infrastructure represents a substantial financial commitment on the part of both private businesses and public administrations. Furthermore, the composition of lithium-ion batteries varies, making the recycling process more intricate. Different battery chemistries, designs and manufacturing techniques can affect the efficiency of the extraction and recovery processes.

Another challenge lies in the collection and transportation of discarded batteries. Establishing effective collection networks and ensuring the safe transit of discarded batteries are crucial to maximising the potential of raw material extraction. As the demand for these metals increases, it will be essential to alleviate the social and environmental concerns around unethical and unsafe mining practices and promote responsible sourcing practices throughout the supply chain.

The extraction and reuse of valuable materials from discarded batteries realign with the principles of a circular economy and resource efficiency. Despite the challenges posed, the industry must continue to invest in sustainable practices and foster collaboration among stakeholders. By doing so, the EV industry can contribute to a greener future while minimising its environmental impact and reliance on primary raw material extraction. ☐

The role of Autonomous Technology **in Maritime Security**

Explore how immersive technology transforms defence manufacturing, enhances autonomy, agility, and global influence in unmanned systems. Evolutionary insights await.

Capt. Nikunj Parashar,
Founder and CMD,
Sagar Defence Engineering

In the realm of defence manufacturing, the integration of immersive technologies has accelerated the world's transition towards autonomous systems, particularly in the development, integration, and deployment of unmanned and autonomous systems with various aerial, maritime surface, sub-surface, and terrestrial platforms. These cutting-edge technologies have revolutionised how militaries conceptualise, design, and utilise unmanned platforms for various missions. Immersive technologies have permeated various industries, offering novel solutions to complex challenges. In defence manufacturing, these technologies play a pivotal role in enhancing productivity, reducing costs, and accelerating innovation by enabling engineers and designers to visualise and interact with virtual prototypes in a simulated environment, facilitating iterative design processes, and minimising the need for physical prototypes. This not only expedites the development cycle but also fosters creativity and experimentation, leading to more robust and optimised designs.

The Crucial Role of Autonomous Technology in Maritime Security

As seen recently in the 40-hour-long operation carried out by INS Kolkata in the Arabian Sea to free MV Ruen from the clutches of Somali pirates, amidst the tense atmosphere of the rescue mission, a pivotal asset in the Indian Navy's fleet proved to be the Spotter, an Unmanned Aerial Vehicle (UAV) used for Intelligence, Surveillance and Reconnaissance (ISR) that relayed vital intelligence during the operation, working in coordination with INS Subhadra and the air-dropped Marine Commandos (PRAHARS) by C-17 aircraft and P8I maritime reconnaissance aircraft. As the spotter hovered above the pirate ship to survey the hijacked vessel, in a moment of desperation, one of the pirates resorted to gunfire, shooting at the UAV to stop the relay of real-time data. The firing on the Spotter, while initially perceived as an aggressive act by the pirates, proved to be a boon as it served as crucial evidence of their hostile intent. By utilizing the intelligence gathered by the Spotter, combined with strategic planning and decisive action, the operation was carried out swiftly. The Spotter's role further underscores the unique contribution of autonomous and unmanned technology in safeguarding maritime security, as their ability to gather crucial intelligence while minimising risk to human life highlights the evolving nature of modern naval operations along with protecting our sailors on the frontlines.

Seamless Human-Autonomy Interaction

This human-machine collaboration fosters a symbiotic relationship wherein operators leverage the autonomy and efficiency of unmanned systems while retaining control and oversight over critical mission parameters. Immersive technologies facilitate the integration of multi-modal sensor suites onboard unmanned platforms.

These sensors provide comprehensive situational awareness, allowing operators to detect and track targets, assess threats, and identify critical points of interest with enhanced clarity and accuracy. Furthermore, AI-driven algorithms enable unmanned systems to analyse sensor data autonomously, identifying patterns, anomalies, and potential threats in near real-time, enhancing decision-making. They also facilitate seamless collaboration between human operators and autonomous systems, empowering operators to monitor, supervise, and intervene when necessary. Through immersive control interfaces, operators can interact with unmanned and autonomous systems in intuitive and immersive ways, visualise mission data, manipulate virtual controls, and engage with digital interfaces.

Advancements in Unmanned Platforms

Unmanned and Autonomous Systems are representing the pinnacle of technological innovation within the indigenous defence manufacturing landscape as we move ahead with the vision of Atmanirbharta in Defence in Amrit Kaal. These systems, built with sophisticated sensors, AI algorithms, and advanced autonomy software, are capable of executing missions with a high degree of autonomy and decision-making prowess.

Immersive technologies play a pivotal role in the

development and deployment of autonomous systems, offering immersive interfaces for human operators to monitor, supervise, and intervene when necessary. Facilitating real-time situational awareness and enhancing human-machine collaboration, these systems, including Unmanned Aerial Vehicles (UAVs), Unmanned Surface Vessels (USVs) and Autonomous Underwater Vessels (AUVs) have witnessed unprecedented advancements propelled by immersive technologies. These platforms offer unparalleled versatility and efficacy across a spectrum of military operations, including reconnaissance, surveillance, intelligence gathering, and combat support.

The integration of AI algorithms and machine learning algorithms empowers unmanned systems with autonomous capabilities, enabling them to navigate complex environments, adapt to dynamic scenarios, and execute missions with minimal human intervention. In recent years, Unmanned Marine Surface Vessels (UMSVs) have emerged as a disruptive force in maritime operations, offering unparalleled capabilities in surveillance, reconnaissance, maritime security, and logistics support.

Immersive technologies are playing a pivotal role in advancing the development and deployment of these autonomous maritime platforms, ushering in a new era of maritime innovation and capability. UMSVs have a wide range of applications across military and commercial domains, including maritime surveillance, border patrol, search and rescue operations, environmental monitoring, and offshore resource exploration. With continued research and development efforts, collaboration between industry stakeholders and maritime agencies, regulatory frameworks governing autonomous maritime operations are essential to unlocking the full potential of UMSVs in enhancing maritime security and resilience. The use of such vessels, along with UAVs, and AUVs creates a multimodal system that offers significant advantages over their manned counterparts, including lower operating costs, reduced risk to personnel, enhanced endurance and persistence, and saving time, money, and human lives.

Indigenous Innovation in Defence Manufacturing

While the integration of immersive technologies in defence manufacturing holds immense promise, they also enable defence manufacturers to adopt agile development methodologies, facilitating rapid prototyping, iteration, and validation of unmanned and autonomous systems, along with enabling defence manufacturers to solicit feedback from end-users and stakeholders early in the development process, ensuring that unmanned systems are tailored to meet operational requirements and user preferences.

This iterative approach to design and prototyping accelerates the development cycle, reduces costs associated with physical prototyping, and fosters indigenous innovation by encouraging experimentation and exploration of novel design concepts. As we move towards bringing Indigenously Designed, Developed, and Manufactured (IDDM) solutions to a global platform, the future of defence manufacturing lies in the convergence of immersive technologies, navigating the complexities and opportunities presented by this technological revolution to ensure the responsible and effective utilisation of such advanced systems in safeguarding national interests in today's globalised world.

Reshaping the landscape

As immersive technologies continue to reshape the landscape of defence manufacturing, the integration of these innovations heralds a new era of agility, innovation, and global influence. From enhancing human-machine collaboration to revolutionising maritime security, unmanned and autonomous systems equipped with immersive interfaces and AI algorithms demonstrate unprecedented capabilities.

The iterative design process fueled by immersive technology accelerates development cycles, fosters indigenous innovation, and ensures tailored solutions for operational needs. With the vision of Atmanirbharta in Defence, the convergence of immersive technologies paves the way for global leadership in defence manufacturing, promising responsible and effective utilisation of advanced systems to safeguard national interests in an ever-evolving globalised world. ☐

Maximising Efficiency: Advancements in High-Speed Machining for job shops

This article delves into the evolution of high-speed machining within the context of general machining job shops, automotive parts suppliers, and other commercial parts manufacturers.

Neha Basudkar Ghate
Joint Editor

High-Speed Machining, originating in the 1920s by Dr Carl Salmon, revolutionised manufacturing by optimising the interaction between cutting tools and workpiece metals. This technique, aimed at creating intricate moulds and aerospace structural components, harnesses critical spindle speeds to manage heat generation at the interface. Its primary objective is to execute rapid, yet delicate, low-pressure cuts, resulting in significantly enhanced material removal rates.

In essence, High-Speed Machining embodies a method for achieving elevated Metal Removal Rates (MRR) through swift, lightweight cuts characterised by high feed rates and spindle speeds. It amalgamates swift motions with meticulous application to attain precision in part production and optimal outcomes. Essential considerations for successful implementation encompass various factors, including tool selection and balance, chip thinning, machine specifications, workpiece and tool rigidity, material characteristics, machining strategies, CAM programming, and cutter selection.

Key Techniques for High-Speed Machining

High-Speed Machining (HSM) encompasses a diverse array of techniques tailored to various applications, offering user-friendly and efficient solutions across operations. Among the standout techniques are:

- **Plunge Roughing:** Plunge Roughing, a CAM tool path programmed manually, emerges as a valuable asset in machining operations. Its distinct advantages include the ability to achieve enhanced cutting rigidity by transitioning forces from the XY plane to the axial Z-axis, facilitating more efficient material removal compared to traditional end milling. Particularly advantageous for deep pockets where side pockets induce significant tool deflection, plunge milling enables roughing even on older machine setups in the workshop. Despite its merits, plunge roughing presents challenges such as centre cut and conventional twisted drill methods, considerations between 2D and 3D plunge roughing, and the occurrence of scalloped edges.

- **Trochoidal Machining / Milling:** Trochoidal machining stands out as a CNC milling method suitable for milling deep pockets, confined cavities, and grooves, particularly in challenging materials like titanium and Inconel. This technique offers a multitude of benefits, including reduced cycle times, compatibility with multi-fluted tools, enhanced material removal rates, prolonged tool life, chip thinning effects, minimised axial passes, and high-speed capabilities, ensuring continuous feed rates.

- **Side Steps:** Side steps represent crucial connectors facilitating smooth transitions between adjacent tool paths during high feed rate operations. They often manifest as sharp stepover moves after a pass, with simple round moves exhibiting sharper performance at elevated feed rates. In recent years, parallel scan line surface machining has emerged as a preferred method for finishing multi-surface models, offering an effective alternative for achieving precise outcomes at moderate feed rates.

Navigating Challenges in High-Speed Machining

High-speed machining presents a spectrum of challenges for machine shops, necessitating careful consideration of various factors such as material properties, spindle capabilities, workpiece complexities, floor space availability, part intricacies, and the suitability of CNC machines primed for high-speed operations.

Adopting a strategic approach is imperative in high-speed machining, as simply pushing tools to their limits risks breakage and inefficiency. However, several common hurdles persist:

- **Work-hardening metals:** Many metals exhibit work-hardening tendencies, particularly at high RPM, leading to increased heat generation during cutting. This can result in catastrophic tool failure unless measures are taken to mitigate heat buildup.

- **Vibration and Chatter:** Elevated speeds heighten the risk of vibration or chatter during cutting processes, significantly diminishing tool lifespan and posing a threat to workpiece integrity.

- **High cutting forces:** Despite the emphasis on speed, high-speed machining entails substantial cutting forces, increasing the likelihood of tools pulling out of their holders and causing significant disruptions.

- **Machine compatibility:** Not all machines, especially older ones, are equipped to handle the demands of high-performance machining, necessitating investment in modern, capable equipment.

- **Advanced toolpaths and training:** Implementing toolpaths conducive to high speeds demands advanced training and proficiency in CAM software, adding complexity to the machining process.

- **Cost considerations:** Achieving true high-performance HSM can entail significant expenses in terms of equipment setup and maintenance, posing financial challenges for shops aiming to optimise performance.

Elevating High-Speed Machining in General Machining job shops

High-speed machining continues to evolve within the realm of high-mix/low-volume general machining job shops, automotive parts suppliers, and other commercial parts manufacturers. Initially defined in the 1990s by spindle speeds surpassing 10,000 RPM to facilitate higher metal removal rates, today's high-speed machining landscape encompasses a more intricate understanding of the entire cutting process.

Advancements in machine tool design have significantly enhanced overall rigidity, minimising vibration during cutting operations. This enhancement enables a more uniform chip load during cutting and mitigates chatter when employing aggressive cutting parameters. Moreover, the prevalence of direct-drive spindles has eliminated gearboxes, further enhancing spindle dynamics. However, some machine tools still lack the necessary axis and spindle rigidity, coupled with adequate spindle power, for effective high-speed machining.

The advent of computing power has revolutionised high-speed machining, enabling faster part production with superior quality outcomes. Modern CNC controllers boast robust capabilities, including the ability to maintain consistent feed rates, resulting in improved surface finishes, extended tool life, and reduced cycle times. Furthermore, the advanced lookahead functionality of powerful controllers allows software to optimise tool paths for enhanced speed and accuracy. Such advancements are only feasible today due to the expanded capacity for high-speed programme data storage and faster data transmission rates.

Over the past few decades, continual enhancements in machine structure design, spindle technology, and computer hardware and software have propelled the capabilities of machine tools in high-speed machining, facilitating increased metal removal rates and reduced cycle times.

Trajectory of innovation and advancement

The journey of high-speed machining in general machining job shops is marked by a trajectory of relentless innovation and advancement. From its nascent stages, characterised by basic spindle speed thresholds, to its contemporary state of intricate optimisation across the entire cutting process, high-speed machining has undergone a remarkable evolution. Design improvements in machine tools, advancements in spindle technology, and the transformative impact of computing power have collectively propelled high-speed machining to unprecedented levels of efficiency and precision. As manufacturers continue to leverage these advancements, the potential for further enhancements in metal removal rates, cycle times, and overall productivity in machining operations becomes increasingly tangible. With the right tools and strategies in place, the future of high-speed machining in job shops promises to be defined by continual progress and optimisation. ☐

Building towards **India's e-mobile revolution**

India's transportation landscape is currently experiencing a significant transformation, driven by the imperative to combat global pollution and reduce carbon dioxide emissions. This article delves into the infrastructure and economics of complete EV adoption that India is working towards.

Rohit Pandit,
Managing Director &
Chairman, Shuzlan Energy

The country's shift towards sustainable practices is primarily exemplified by the widespread adoption of Electric Vehicles (EVs). However, several critical obstacles continue to impede the widespread embrace of EVs. These challenges encompass limitations in battery technology, the inadequacy of charging infrastructure, a dearth of publicly accessible charging stations, suboptimal placement of charging infrastructure and the lack of coordination among charging station operators—all collectively hamper EV growth prospects.

India's current EV trajectory

India's shift from Internal Combustion Engine (ICE) vehicles to EVs is in its early stages, with EVs accounting for just 0.1 percent of total vehicle sales in the country. However, a significant push is for this transition to be completed by 2030. The government is actively encouraging automobile manufacturers to pivot towards EV production, aiming to save up to US$ 60 billion in oil expenditure, reduce emissions by 37 percent and decrease reliance on fuel imports. This shift safeguards against vulnerabilities associated with volatile crude oil prices and currency fluctuations.

The current limitations in battery capacity and the restricted driving range of EVs pose challenges to their broader adoption. The prevailing trend of continually adding vehicles reliant on expensive imported fuels is not sustainable, particularly in congested cities grappling with infrastructure constraints and severe air pollution. Consequently, the transition to electric mobility emerges as a promising global strategy for decarbonising the transportation sector.

The power of infrastructure

The availability of charging infrastructure plays a crucial role in shaping the demand for various categories of EVs. Moreover, the limited driving range of EVs remains a persistent concern for drivers, as a fully charged EV typically offers approximately one-fifth the driving range of traditional diesel or petrol vehicles.

The issue of range anxiety, which plagues EV drivers due to their limited driving range, can be mitigated with modern technology. Advanced fuel displays that provide consumption history data can be instrumental in alleviating this concern. To address this, several critical measures need to be taken, including expanding charging station networks, developing fast-charging batteries and enhancing battery energy density. Consider a scenario where EV charging stations are as commonplace as traditional petrol pumps. It will help reduce the anxiety among the drivers. These initiatives are pivotal in reducing range anxiety and facilitating the broader adoption of EVs.

Charging stations

EVs use alternating current (AC, level-1 and level-2: slow charging) or direct (DC: fast charging) chargers. There are two types of charging: home charging and public charging. Home charging is the most common type of charging. The charging process takes time, and customers are expected to charge the EVs at night. The metering is connected directly with home metering, so it has no separate billing. However, a policy may soon emerge to regulate home charging with individual metering and guidelines for builders to install EV charging stations in flats and apartments mandatorily.

The GoI has proposed to set up charging stations at every three km in cities with a population of more than a million and every 50 km on highways. Municipal authorities will facilitate land and offer monetary incentives for charging stations. In the next five years, India will have 30,000 slow charging stations and 15,000 fast commercial charging stations. State-owned energy sector utilities like NTPC, PGCIL and IOCL have planned to build charging stations at several identified locations in the selected cities in India. Presently, more than 60,000 fuel stations are dispensing gasoline and diesel in India, and these may also be the potential locations to be selected for installing EV charging stations.

Standardisation

Implementing a standardised charging system is paramount in streamlining the EV experience and fostering the widespread adoption of this eco-friendly mode of transportation. By adhering to global standards

like Combined Charging System (CCS) or CHAdeMO, the automotive industry can ensure that EVs from various manufacturers seamlessly interface with and utilise the same charging infrastructure.

This standardisation has several crucial advantages. First and foremost, it eliminates the fragmentation and confusion that can arise when different EV models require distinct charging connectors and protocols. Such uniformity simplifies the process for EV owners, allowing them to access charging stations without compatibility concerns confidently. In essence, it mirrors the convenience and familiarity associated with traditional fuelling stations, where drivers of various vehicles can use the same pump nozzle.

Moreover, global standards facilitate interoperability, which is essential for the growth of the EV market. Whether you own a Tesla, Nissan, BMW, or any other EV brand, you can plug into a CCS or CHAdeMO charger and expect a consistent and reliable charging experience. It promotes a level playing field and encourages competition among EV manufacturers, as consumers are less tied to a specific charging ecosystem associated with a particular brand.

Battery swapping stations

Government authorities are exploring implementing a battery-swapping model to address the challenges hindering the widespread adoption of EVs. This concept, previously introduced in countries like Israel and China with varying degrees of success, presents unique challenges primarily related to battery size and power.

One of the central complexities of the battery swapping model lies in the diversity of battery specifications among different EV manufacturers and models, such as the distinction between a Maruti Alto and a Honda City. To accommodate such variability, this model necessitates a standardised vehicle design capable of accommodating interchangeable batteries—a feat that proves to be technically challenging.

An alternative approach being considered is battery leasing, which holds the potential to reduce the overall ownership cost of EVs. However, the critical hurdle that remains unresolved is the establishment of a widespread network of easily accessible charging points throughout cities. This infrastructure gap poses a significant barrier to the seamless adoption of EVs, regardless of whether the battery swapping or leasing model is employed.

Policy interventions and collaborative growth

Policy-related challenges represent a significant barrier to adopting EVs. Governments and stakeholders must collaborate on standardising policies covering manufacturing, sales and the necessary infrastructure and operational support to promote EVs effectively. Government agencies should formulate clear and straightforward policies concerning EVs and their components.

Implementing attractive and uncomplicated tax policies can significantly boost EV manufacturers. Lower taxes on components can lead to an overall reduction in vehicle costs, making EVs more appealing to consumers. Notably, India's electricity production relies heavily on conventional power plants.

However, advancements in renewable energy technologies are steadily reducing generation costs. As renewable energy becomes more prevalent in the power grid, government entities can revisit electricity tariff policies and provide increased incentives to encourage the use of renewable power sources. This shift can have a positive impact on the broader adoption of EVs.

A way forward

Looking ahead to 2030, achieving a 30 percent adoption rate for EVs would necessitate an additional daily demand of 24,600 MWh of electricity. This, in turn, would require a substantial expansion of charging infrastructure tailored to both the type of vehicle and its usage patterns—ranging from slow to fast charging.

Meeting the energy needs of a burgeoning population of EVs, particularly in major urban centres, would require a concentrated focus on specific areas like large residential complexes, bus depots and shopping malls. Effective collaboration among key stakeholders in the EV industry is paramount to creating a sustainable ecosystem capable of supporting the widespread deployment of charging stations.

This collaborative effort should involve EV and charging system manufacturers, charging service providers, utility companies, regulatory bodies, distribution companies (DISCOM) and funding agencies, all working energetically together to address the challenges and seize the opportunities presented by the growing EV market. ☐

Digital Twin: The Doorway to Smart Manufacturing

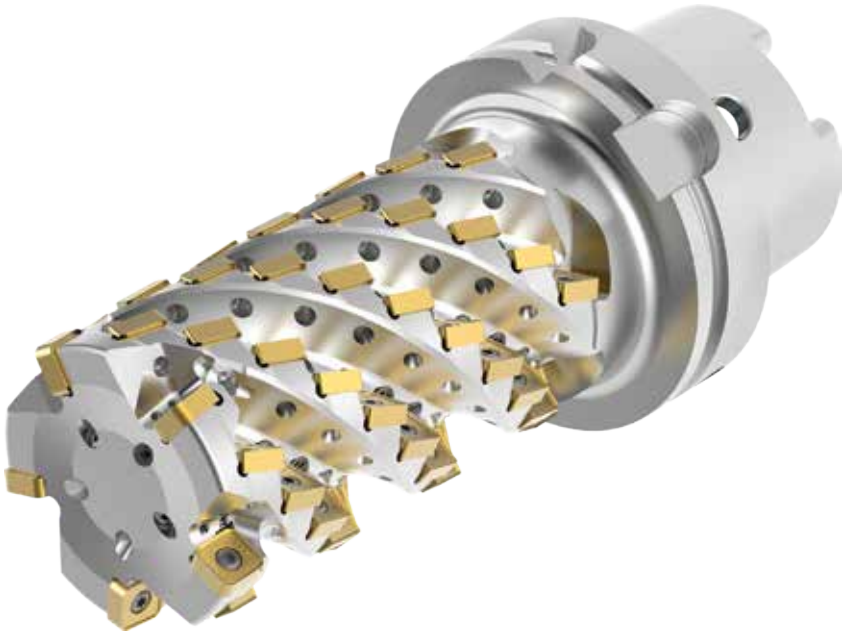
Digital Twin serves as a virtual blueprint for precision machining, offering a comprehensive platform for meticulous planning and real-time decision-making. With a focus on customisation and efficiency, Kennametal equips manufacturers with cutting-edge tools for crafting bespoke tool path simulations and accessing the latest ‘CNC programs’.

Karthik Raman,
Product Management,
Kennametal India

We live in a fast-paced world, one where new technologies are adopted faster than ever before. In manufacturing, specifically in in-part production, we're observing a transformation due to the ever-increasing use of cloud-enabled, connected data platforms that aid high-volume transactions, interactions, and relationships from hundreds of data sources. These platforms also unify data from multiple standalone sources and present a comprehensive view to support real-time decision making—today, more commonly referred to as Data Driven Decisions (DDD).

Also evolving are customers' machining requirements. Customer requirements can range from machining a complex 5-axis part with a high machinability index and tight tolerances to prioritising the optimisation of machining strategies to streamline processes, drive productivity, control costs, and reduce waste.

To help customers solve machining challenges, Kennametal utilises an innovative end-to-end solution-driven approach called, "Digital Twin."



The Digital Twin is a blueprint for smart machining.

A 'digital twin' is a virtual model that is designed to represent a physical object or product accurately and precisely, in this case. It can be tested and validated before it is put into production and into the market. A digital twin allows engineers and process planners to identify any process failures before the part goes into actual production.

Complex multi-axis machines require a deep knowledge and understanding of fixtures, cutting tools, and processes, as well as programming.

Kennametal's digital twin solution helps customers visualise the complete machining operation in a virtual setting with the right process parameters so that issues or adjustments can be addressed in the planning stages as opposed to later, potentially halting operations. Digital twin replicas also help translate machining results to performance by allowing for a precise estimation of chipping loss, cycle time, and executable NC codes. The bottom line, better decisions are made on the shop floor.

With Kennametal and its blueprint for smart machining, customers can create custom tool path simulations and access the latest CNC programmes for metal cutting tools and machining strategies, while continuing to deliver proven machining and manufacturing solutions.

Kennametal can help take your manufacturing to the next level. ☐

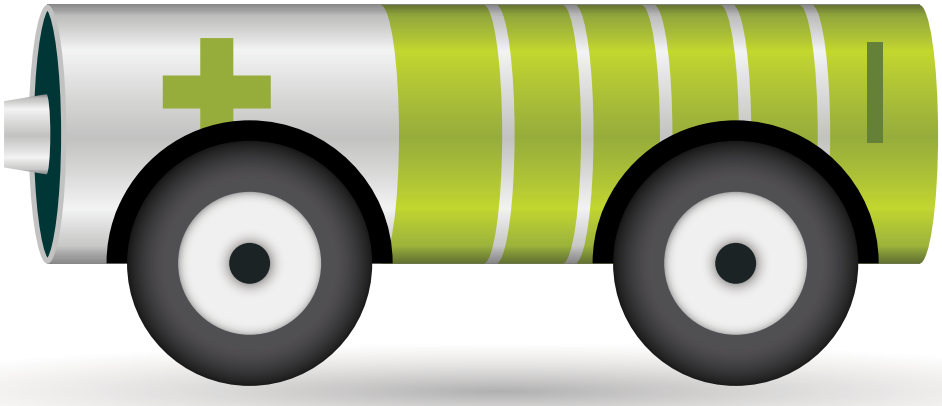
Battery Swapping - a solution for India's E-Mobility

As EVs gain traction as a clean energy solution, India is poised to become a global hub for electric mobility. Battery swapping is key, in addressing challenges like range anxiety and infrastructure scalability. With ambitious deployment targets and a growing ecosystem, India is on track for mass EV adoption, backed by supportive policies and incentives. This article throws light on India's evolving electric mobility landscape, spotlighting the pivotal role of battery swapping in driving sustainable transportation.

Dilip Chenoy,
Advisor, India Battery Swapping Association (IBSA)

Sutirtha Ghosh,
Secretariat, IBSA

Tannaz Ahmed,
Secretariat, IBSA



The automotive industry is rapidly evolving in terms of technology and propulsion choice. There is a strong focus on minimising environmental impact.

Two key factors driving this are- first, the country's nationally determined contributions towards combating climate change, and second, the goal of reducing the nation's dependence on imported petroleum-based fuels. India's transportation sector is undergoing a paradigm transition from fossil fuels to electric mobility.

Electric Vehicles (EVs) have been introduced as a clean energy initiative, as they have low or zero emissions. EVs are becoming an integral part of OEMs' product mix and business strategies. Some OEMs are solely EV producers.

Global EV Hub

India is all set to become a global electric mobility hub. With rising crude oil prices, EV sales have achieved an all-time high and are anticipated to rise further, with 1.5 million units sold in 2023, marking a 50 percent increase from the previous years. The increase in the number of EVs has created a huge need for charging infrastructure. There is also a continuing emphasis on safety regulations and standards. The focus is on increasing charging infrastructure and reducing charge time at the same time addressing range anxiety of vehicle users.

Battery swapping, akin to petrol pumps for Internal Combustion Engine (ICE) vehicles, presents a unique opportunity, particularly for light vehicles like two-wheeler (2W) and three-wheeler (3W) vehicles in fleets and B2B applications. While there is sustained push to promote the expansion of charging infrastructure, promoting the installation of charging points, there are multiple challenges for setting up charging stations at scale, both in rural and urban India. These include constraints of space and sufficient availability electricity in terms of load and the number of existing three phase connections. Battery swapping is a good alternative as it can help address these specific challenges and more.

Further, it has the potential to enhance the attractiveness of electric mobility by addressing both the initial cost of ownership compared to conventional vehicles and, importantly, the time taken to charge the vehicles and range anxiety of EVs. India has witnessed a notable uptick in battery swapping stations, expanding their operational footprint annually. There are currently about 2500 battery swap stations that the industry has installed pan-India for electric 2Ws and 3Ws, and vehicles running this technology have successfully completed 1.7 billion e-KMs. In the next five years, the industry is aiming to install 130,000 units of swap stations which can cater to the demand generating from 18 million units of 2W and 3W vehicles.

Largest Swapping Market

As the second largest 2W and largest 3W vehicles producer globally, India presents one of the largest target markets for battery swapping. Some of the notable players in the space include SUN Mobility, Gogoro, Ampere by Greaves, Honda Power Pack Energy India, Battery Smart, Mooving, and RACEnergy.

Recent years have witnessed increased investors' interests in this space. Going forward, as per industry estimates, the country will need at least 450,000 swapping stations to meet the demand arising from different vehicle segments, which would require an investment of more than USD $ 20 Billion.

The Government of India has introduced a bouquet of incentives and subsidies aimed at driving the adoption of EVs and growing the associated infrastructure, like battery swapping and charging stations, which has resulted in significant uptake of electric vehicles in the country.

As new policies are introduced, it will be appropriate that the government looks at fostering greater choice and allows all vehicle technology and charging methods to evolve. This will facilitate the development of technology and solutions for charging to emerge based on their efficiency, viability, market conditions, and consumer preferences.

EV self-sufficiency

In order to enable the EV industry to achieve self-sufficiency of the level that could match the Internal Combustion Engine (ICE) vehicle manufacturers in India today, coordinated effort by the centre and states is needed. By incentivising manufacturers of electric vehicles, components, and charging/swapping infrastructure, many players will be drawn into the market with the prospects of

long-term viability and significant future growth potential for electric vehicles in the country.

Although electric mobility is a relatively nascent market in India, there is an urgent requirement for its accelerated development and evolution in order to reduce costs, improve the range and decrease recharging time.

Battery as a Service

In August 2020, the Ministry of Road Transport and Highways (MoRTH) authorised the sale and registration of EVs without batteries, promoting the Battery as a Service (BaaS) model. This initiative was aimed at reducing production costs and, as a result, the retail price of EVs, potentially making them more attractive to consumers by alleviating the significant price disparity with conventional vehicles.

Offering batteries on a subscription basis eliminates the initial expense of purchasing a (swappable) battery and facilitates the broader production and acceptance of battery-swappable EVs, thanks to a simplified registration process. However, more than three years after this directive was issued, challenges persist, particularly with the registration of swappable battery vehicles at Regional Transport Offices (RTOs), with respect to vehicles without batteries.

Since the time the government introduced the draft battery swapping policy in April 2022, there has been considerable progress and alignment of views between the vehicle manufacturers and the battery swapping industry and other stakeholders. At a recent meeting there was also agreement that a policy with a few modifications could be announced.

Given this consensus, it is imperative that the battery swapping policy be brought in as soon as possible. This could even be a part of the 100-day agenda for the new government.

Competitive Environment

For the EV sector to flourish, it is crucial that the policies give equal emphasis to EVs with fixed and swappable batteries, thereby ensuring a fair competitive environment for all technologies. Whenever a new fuel choice technology is made available, there is a need for an increased joint action between all stakeholders in the centre and states to create the necessary momentum.

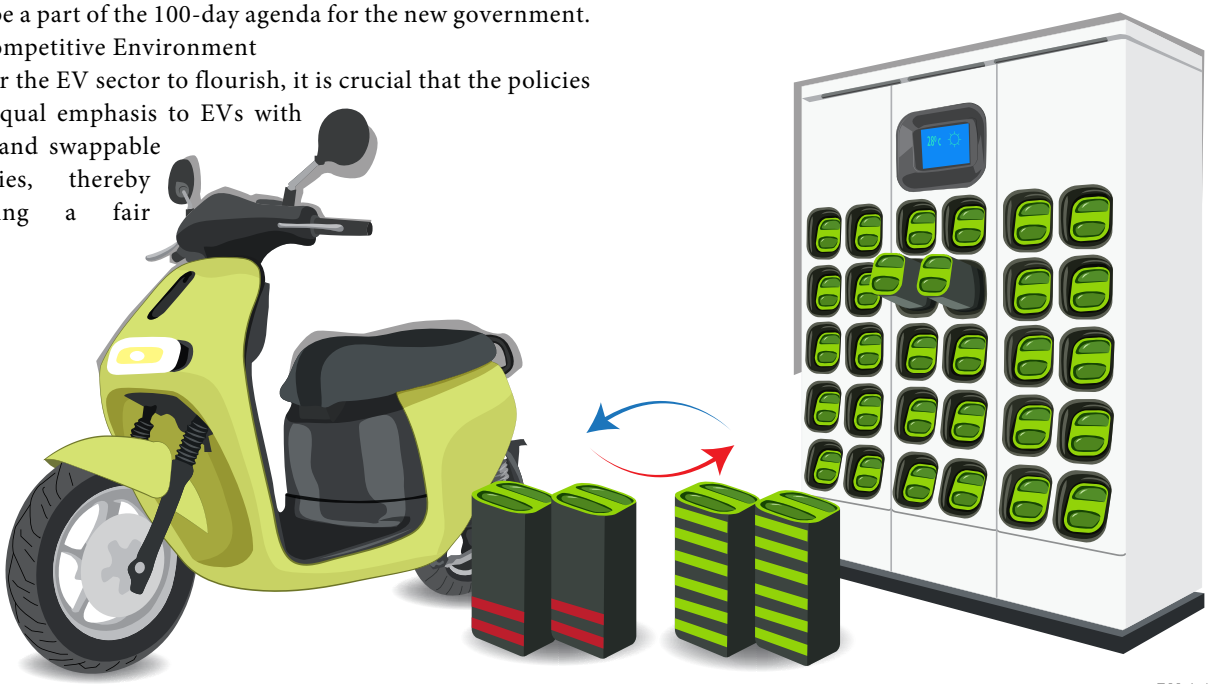
The Union Budget 2024 highlighted the need to focus on 'Strengthening e-vehicle ecosystem by supporting manufacturing and charging'. Charging infrastructure would naturally include battery swapping as well. Mainstreaming battery swapping through equivalent financial support can be one of the ways to boost EV penetration among 2Ws and 3Ws, by making it cheaper to buy EVs (without batteries).

Financial Incentives

It is well known that new industries and ecosystems are best catalysed with suitable financial incentives for the product providers and end users. Presently, the electric vehicles sold with fixed batteries are taxed at 5 percent while the lithium-ion batteries used for battery swapping purposes are taxed at 18 percent when sold separately. Battery swapping business models require an inventory of 1.2x to 1.3x batteries (up to 1.5x) for every vehicle on the road.

The higher GST rate puts battery swap EVs at a disadvantage relative to fixed batteries, and thus demands parity. The focus should be on the benefits for the consumer which includes a lower rate for swappable batteries through adjusting the GST mechanism and inclusion in FAME III for end user subsidy. This will go a long way in enabling penetration of 2Ws and 3Ws and faster adoption by fleets.

With India having a goal to 100 percent conversion of 2Ws and 3Ws to electric by 2030, battery swapping is the way to expedite the adoption of electric vehicles in India. A policy would align all stakeholders on the mission and would incentivise such a capital-intensive industry. ☐



A sustainable space **heating solution**

With the world's increasing focus on sustainability and decarbonisation, innovative technologies are emerging to tackle the challenges of energy conservation and carbon emissions. Here is how Phase Change Materials (PCMs) are changing the field of thermal energy storage fields.

Samit Jain,
MD, Pluss Advanced Technologies

The growing need for sustainable space heating

PCMs are especially valuable in space heating applications for residential, defence or other buildings or storage purposes, due to their ability to store a large amount of energy in the form of latent heat. They provide an environmentally sustainable alternative to traditional heating systems that rely on fossil fuels.

Space heating is a critical aspect of providing comfortable and habitable environments, especially in extreme weather conditions. In regions where temperatures can plummet to sub-zero levels, heating solutions become essential for human comfort, health and productivity. In many parts of North India that face extreme weather conditions, residents rely on diesel or kerosene, apart from wood-burning for heating, due to frequent disruptions to electricity. In geographically harsh and distant terrains as well, electricity is often unavailable.

Even if gas-based heating systems are available, with the ability to upgrade to modern heating systems that use electricity, this is often put off, as there is no guarantee of an uninterrupted electricity supply. At extreme temperatures, the battery storage becomes unusable or defunct, due to their reaction to temperature. For this reason, batteries are oversized and occupy precious space, because only 50 percent of the capacity can be utilised, and the cost of batteries per kilowatt is more than thermal storage.

Challenges of traditional heating methods

Traditional heating methods, such as wood-fired stoves, kerosene heaters and diesel-based systems, have many challenges. Some of them are:

- **Carbon emissions:** Wood-fired stoves and kerosene heaters release harmful carbon emissions, contributing to air pollution and climate change.
- **Safety concerns:** Traditional heating methods using wood or kerosene can lead to indoor air pollution and, in some cases, suffocation risks.
- **High costs:** In remote areas, transporting and procuring fossil fuels can be expensive, making traditional heating methods economically challenging.
- **Unreliable power supply:** In areas with unreliable electricity supply, electric heating systems may not be feasible.

PCM 29: The sustainable heating solution

PCMs release and absorb heat at a constant temperature, a process that is repeatable over a substantial number of cycles. The PCM's unique property is its ability to store and release large amounts of thermal energy during a phase transition, such as melting or solidification. The use of PCMs finds a strong application in indoor space heating, as an alternative to traditional HVAC systems, which can be energy-intensive, tedious to install and lead to carbon emissions.

At PLUSS Advanced Technologies, a subsidiary of CUMI, and part of the 120-year-old Murugappa Group, we have developed PCM 29, an environmentally sustainable phase change material that offers a solution to the challenges posed by traditional heating methods. PCM 29 is a non-toxic and inorganic material that does not use rare earth metals, making it an environmentally friendly alternative with zero emissions.

The major advantages of relying on PCM 29 are:

- **Renewable energy integration:** PCMs can harness renewable energy sources like solar radiation to store heat, making it a sustainable and efficient solution for space heating.
- **Energy conservation:** PCMs store heat passively and release it at a constant temperature, reducing the need for continuous energy consumption.
- **Thermal battery:** PCMs act as thermal batteries, storing excess heat during the day and releasing it during the night, ensuring continuous heating, even in the absence of a heat source.
- **Reduced carbon footprint:** By replacing traditional heating methods that rely on fossil fuels, PCMs significantly reduce carbon emissions, contributing to decarbonisation efforts.
- **Reliable operation:** PCM is not dependent solely on solar heat but can work with any heat source, providing a versatile and dependable solution for

space heating in various environments.

- **Cost-effective:** These materials offer a cost-effective alternative to battery storage systems that are not reliable in extreme temperatures.

A heating solution for defence

Defence establishments and camps are often located in harsh terrain where electricity is difficult to come by. Installing a traditional power grid or setting up a heating system based on fossil fuel is time-consuming and expensive. In such situations, PCM-based heating can offer an immediate solution. PLUSS installed such a solution at the Field Petroleum Depot at Leh, a strategic storage weaponry and fuel location for the army. Traditionally, the jawans relied on coal and kerosene-based heating methods to keep the rooms warm. Thus, to address this issue, the PCM system was introduced.

The PCM panels, integrated into the dormitory heating system, played a significant role in transforming the living conditions of the jawans. The PCM panels absorbed and stored heat during the day when the sun was available, and the stored heat was released at night, ensuring a continuous and comfortable temperature. This successful application of PCM technology demonstrated its potential for transforming space heating practices in crucial defence locations, contributing to sustainability efforts within the army infrastructure.

Applications in construction and mining

Meanwhile, in the construction and mining industry in Colombia, a unique application of PCM technology was deployed to cater to the needs of project managers and staff working in on-site offices at mining locations. These offices required a comfortable environment with air conditioning and essential amenities such as laptops and refrigerators. Traditionally, companies rented out these units, equipped with air conditioning systems powered by diesel generators to maintain a constant temperature of 24°C. To provide a more sustainable and energy-efficient solution, a PCM system coupled with solar-PV was introduced: a chiller unit with a compressor, powered by solar-generated electricity, stored cold energy in the PCM panels. As a result, the site office rooms maintained a comfortable working environment of around 25°C, without relying on electricity or diesel generators. In this system, lead-acid or li-ion batteries are eliminated

Sustainable temperature control solution

Phase change materials find several use cases across sectors and applications. Some of the applications are:

- **Temperature control for telecom and electronics:** Telecom towers that house electronics require continuous air conditioning to function optimally. To counter the challenges posed by power outages and ensure the electronics' temperature remained below 35°C, PCM 29 was ingeniously used to maintain temperatures around 33°C.
- **Wearable tech:** PCMs used in jackets can help provide thermal comfort in extreme weather conditions since they can maintain a comfortable temperature for up to four hours.
- **Portable transportation solutions:** Temperature control of pharma and perishable food products.
- **Refrigeration in trucks:** A non-fossil fuel-based refrigeration system which can be charged electrically.

Conclusion

PCMs are proving to be a transformative solution in the pursuit of sustainability and decarbonisation, offering innovative ways to address the challenges of energy conservation and carbon emissions. An environmentally sustainable material with diverse applications, including heating, cooling and temperature regulation, they can find purpose in various industries. By harnessing renewable energy sources and acting as efficient thermal batteries, PCMs provide cost-effective and reliable alternatives to traditional heating and cooling methods. Successful pilots in extreme weather conditions and strategic locations exemplify the real-world benefits of PCM integration. As the world seeks more efficient and environment-friendly solutions, PCMs are proving to be a game-changer in the ongoing journey towards a more sustainable and decarbonised future. ☐

Innovative modular design with intuitive toolchain

Danfoss' recently released AlsmartTM range of universal programmable controllers is the smart, compact, and powerful brain of an HVAC unit (chiller, rooftop, heat pump, dedicated outdoor air systems) with the latest technology inside to enable best-in-class application management, facilitate the use of low GWP natural refrigerant gases, and introduce high-technology module-based design and simulation to reduce time to market. The Alsmart Design and Alsmart Service Tool provide a complete and intuitive software platform, putting the user at ease with programming tools compliant with IEC 61131-3 and providing a high degree of connectivity and a high level of cybersecurity thanks to compliance with IEC 62443. Alsmart Design is the core of the toolchain, it supports five main standard programming languages, with an automated test function embedded, a simulation mode function, options to design and customise your user interface, and many other features that will make a difference in optimising the performance of your HVAC application.

AlsmartTM

Danfoss | Pune

High-performance linear motor series

Dunkermotoren has introduced the ServoLine (SL) 38 STL, a linear motor series within the SL 38 product family. This high-performance motor series is crafted from stainless steel, ensuring material quality and exceptional resistance to environmental factors. The SL 38 STL linear motor is an ideal companion for applications requiring superior power and speed, boasting peak forces reaching 3700N and accelerations surpassing 200 m/s2. Dunkermotoren's motor elevates system throughput to high levels while ensuring maximum precision. The stainless-steel housing of the SL 38 STL achieves an impressive IP protection level of IP69K thanks to its sophisticated drive design featuring smooth surfaces, specialised screw connections, and enhanced seals. This design ensures resistance against environmental impacts, providing effortless and comprehensive high-pressure cleaning. Additionally, the motor exhibits high corrosion resistance even with frequent exposure to disinfectants and detergents. Linear motors are utilised in various applications, offering advantages such as high precision, rapid speeds, and the absence of mechanical wear.

ServoLine (SL) 38 STL

Dunkermotoren | Germany

Connectors for electrical safety and mechanical reliability for medical devices

Fischer Connectors has released new First Mate Last Break connectors in its low-voltage multipole Fischer Core Series, to offer outstanding levels of electrical safety, mechanical reliability, and ease of use for operators of medical devices in compliance with IEC 60601-1.

The new Fischer Core FMLB connectors are available in two sizes ('size 104' with a 15 mm diameter plug, and 'size 1031' with a 13 mm diameter plug), and three mixed low-voltage configurations. Fischer Core 104 A 130 and Fischer Core 1031 A 105 feature 14 pins: 3x 0.9 mm power contacts for a maximum current of 9.5 A for size 104 / 8.1 A for size 1031, and 11x 0.5 mm data contacts (incl. a longer FMLB contact for ground) for 5 Gbit/s Ethernet. As for the Fischer Core 104 A 131 connector, it features 12x power and data contacts of 0.5 mm (incl. the ground/FMLB longer contact) for 4.2 A and 5 Gbit/s Ethernet.

First Mate Last Break connectors

Fischer Connectors | Haryana

High-speed phase noise analysis

Rohde & Schwarz introduce dedicated phase noise analysis and VCO measurements up to 50 GHz with the R&S FSPN50. The R&S FSPN provides both high-speed measurements and accuracy for characterising sources such as synthesisers, VCOs, OCXOs, and DROs. Since a trade-off between increasing the speed of the test and higher accuracy is inevitable, users can choose the setting that best suits their application. This makes the R&S FSPN an ideal solution not only for production tests but also for many oscillator development requirements. The new R&S FSPN50 covers the frequency range from 1 MHz to 50 GHz and complements the existing 8 and 26.5 GHz models. For engineers both developing and producing high-quality oscillators, the R&S FSPN50 supports applications in the Ka band from 26.5 to 40 GHz, in the Q band (36 to 46 GHz), and in the lower V band up to 50 GHz. Applications include wireless communication, satellite services, military systems up to 50 GHz, targeting radars, and 5G FR2.

Phase noise analysis and VCO measurements

Rohde & Schwarz | New Delhi

Remote visibility of machine processes

Kawasaki Robotics and Olis Robotics are combining forces to link Kawasaki's smart industrial robots with Olis' plug-and-play remote monitoring, control, and recovery solution, Olis Connect. Combining technologies allows machine operators and industrial manufacturers to benefit from better remote visibility of machine processes (which reduces the need for costly overheads associated with human worker employment) and helps to maintain production flow, reducing downtime. The Olis Connect system comprises edge-hosted, integrated hardware and software for monitoring, controlling, and recovering industrial robots during production. The integrated solution provides machine operators with low-latency video streams to visually assess machine status. Video alerts help prompt the diagnostic process, and once complete, operators can use teleoperation via their phone or tablet to restart their machines and get production back up and running. According to Olis, it only takes 30 minutes to set up its Connect offering, offering a true plug-and-play experience for customers.

Olis Connect

Kawasaki Robotics | Haryana **Olis Robotics | Washington**

Milling grade to maximise your productivity

Seco Tools recently released the MP1501, MP2501, and MP3501 milling grades, which deliver high reliability for steel and cast iron machining. This milling grade increases process security and cost-effectiveness, resulting in savings of up to 20 percent. These Duratomic® grades with improved coating offer exceptional toughness and edge strength that prevent comb cracks and unexpected breakage. This offers the highest level of productivity, tool life predictability, and process reliability. Used edge detection will make it obvious which insert edges are used and prevent insert waste. MP1501 for medium-rough milling for hardened steel (up to 45HRC) and roughing grey as well as nodular cast iron, MP2501 for milling steel and easy/medium stainless steel, suitable for machining with or without coolant and providing excellent finishing ability; and MP3501 comes with increased toughness and good heat resistance for substantially increased tool life and improved process security.

MP3501 range

Seco Tools | Pune

Isolated power module with high efficiency

Würth Elektronik has a new arrival, the MagI³C-FISM power modules: WPME-FISM 'Fixed Isolated SIP/SMT Module' SMT-8 with 3.3 V to 5 V, rated for 1 W POUT. The DC/DC voltage converter with fixed output voltage and integrated switching power stage, transformer, as well as input and output capacitance, is 100 percent pin-to-pin compatible with the previous MagI³C-FISM. It has improved properties: the efficiency goes up to 84 percent, the ambient temperature range has been increased to 105°C and the isolation voltage is 3 kV (for 60 seconds). Like some of its predecessors, this power module has continuous short-circuit protection. The MagI³C FISM power modules have the advantage that no external components are required for operation, and the effort required for circuit design is therefore minimal. Applications for the module include supplying voltages for interfaces and microcontrollers in test and measurement technology or industrial electronics.

MagI³C-FISM power modules

Würth Elektronik | Bengaluru

Plug-and-Play switches for industrial ethernet networks

Westermo has recently added to its product line a new series of unmanaged industrial Ethernet switches, the SandCat five-port fast Ethernet switch series. It comes in a user-friendly and compact design and is set to complement the company's existing range of managed switches for a versatile and reliable solution for expanding data networks.This series caters to the increasing reliability, complexity, and bandwidth demand of various industries like utilities, marine, manufacturing, and energy industries with its support of fast 100 Mbit/s speed requirements. Designed for mission-critical applications, the new switches provide an affordable means of establishing network communication for multiple end devices. With a built-in fibre port, communication capabilities in the industrial setup can be extended over longer distances or between sites, since fibre can extend far beyond the range of typical wired networks. This new series is suited to increasing the port counts of these higher-level managed switches, allowing the installation of more end devices.

The SandCat series plug-and-play unmanaged industrial Ethernet switch

Westermo | Sweden

Highlights: May 2024

» Aerospace Engineering

Aerospace Engineering encapsulates a myriad of disciplines, seamlessly blending principles from mechanical, electrical, and computer engineering, as well as materials science and aerodynamics, to design, develop, and propel aircraft, spacecraft, and satellites. This article throws light into the world of aerospace engineering, exploring the latest trends, innovations, and collaborations driving the industry forward.

» Lighter and Stronger Materials for Greener Aircrafts

In the realm of aviation, the pursuit of efficiency, sustainability, and safety has long been a driving force behind innovation. This development enhances aircraft performance to contribute towards greener aviation practices. This section delves into the transformative potential of these materials and their role in shaping the future of flight.

» Robotics and Industrial Automation

Robotics and automation technologies are reshaping industries, driving productivity, and revolutionising processes like never before. This section explores the latest trends, innovations, and best practices in robotics and industrial automation, uncovering how forward-thinking companies are leveraging these tools to drive efficiency, enhance quality, and unlock new opportunities for growth.

» Supply Chain Disruptions in Aviation and Defence Industry

In recent years the aviation and defence sectors have seen a surge in disruptions, ranging from geopolitical tensions to natural disasters and global pandemics, profoundly impacting the sector's ability to maintain continuity and meet demands. The Special Feature explores the multifaceted nature of supply chain disruption within the aviation and defence industry. We will examine the root causes behind these disruptions, the strategies employed by industry stakeholders to mitigate risks, and the technological innovations driving resilience and adaptability in the face of adversity.

COMPANY INDEX

Name	Page
Ador Welding	20
BattRE Electric Mobility	26
Cattini e Figlio Spa	08
Cattini Power Transmission	08
Cybernetik Technologies	11
Danfoss	50
DN Solutions India	07
Dunkermotoren	50
Emuge-Franken India	25
Erwin Junker Maschinenfabrik GmbH	29
FANUC	09
Fischer Connectors	50
Fronius India	20
ifm electronic India	02
India Battery Swapping Association (IBSA)	44
IQM	09
Iscar India	Front Inside Cover
JBM	08
Jyoti CNC Automation	01
Kawasaki Robotics	51
Kennametal India	42
Keysight Technologies	08
Lien Chieh Machinery Co.	Back Inside Cover
LMT Tools India	Back Cover
Metastable Materials	30
MMC Hardmetal India	14, 15
NVIDIA	09
Olis Robotics	51
Omega Seiki Mobility	12
Pluss Advanced Technologies	47
PMT Machines	21
Recyclekaro	08
Riot Labz	22
Rohde & Schwarz	50
Sagar Defence Engineering	33
SCALINQ	09
Seco Tools	51
Shuzlan Energy	39
SkyDrive Inc	09
Sokudo India	10
Suzuki Motor Corporation	09
Tessolve	08
Volvo Cars	09
Westermo	51
Würth Elektronik	51

EM

IMPRINT

Publisher & Director
Dhiraj Bhalerao
dhiraj.bhalerao@pi-india.in
Contact: +91 9820211816

Editorial Director
Arun Bhardwaj
editor@pi-india.in

Joint Editor
Neha Basudkar Ghate
neha.basudkar@pi-india.in

Assistant Editor
Sanjay Jadhav
sanjay.jadhav@pi-india.in

Digital Content Developer
Anushka Vani
anushka.vani@pi-india.in

Design and Layout
Somnath Jadhav
somnath.jadhav@pi-india.in

Overseas Partner
Ringier Trade Media Ltd
China, Taiwan & South-East Asia
Tel: +852 2369 - 8788
mchhay@ringier.com.hk

Editorial & Business Office
publish-industry India Pvt Ltd
325-326, 3rd Floor, Sohrab Hall
21 Sassoon Road, Pune – 411001
Maharashtra, India
Tel: +91-7410009435/36

Subscription
Cover Price: ₹ 100
Annual Subscription Price: ₹ 1200
em.magazine@pi-india.in
Tel: +91-7410009435/36

Printing
United Multicolour Printers Private Limited,
264/4, Riverview Apartment,
Shaniwar Peth, Pune 411 030, India

Internet http://pi-india.in/

Digital edition http://pi-india.in/magazine

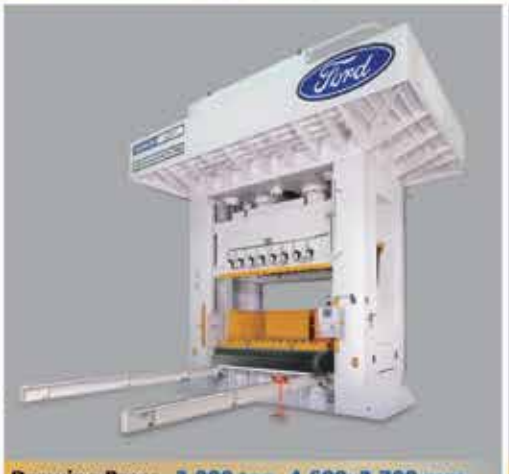
Since 1947

HYDRAULIC PRESSES

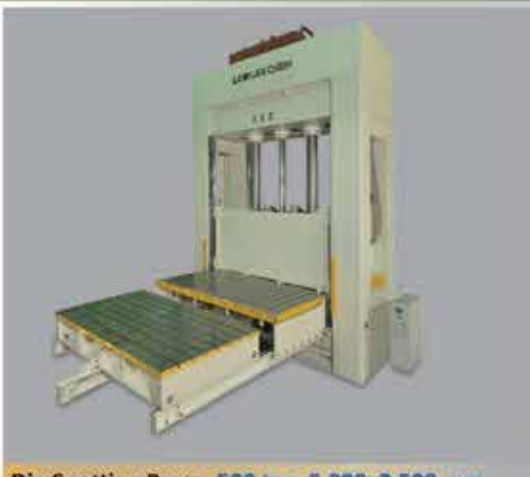
from 50 ~ 15,000 Tons

Tandem Line
1,200 ~400 ton 3,500 x 2,200 mm

Forging Press 12,000 ton 2,700x2,500 mm



Drawing Press 3,000 ton 4,600x2,700 mm



Die Spotting Press 500 ton 5,000x2,500 mm

CCL Laminating 800 ton 20 opening 50"x56"

CCL Laminating 900 ton 16 opening 53"x59"

Sheet Metal Forming
PCB/CCL Laminating Press
& Plywood Press

LCM MACHINERY

LIEN CHIEH MACHINERY CO., LTD.
Tel: +886-3482-7176 info@lienchieh.com
www.lienchieh.com

77 Since 1947 ANNIVERSARY






RNI NO. MAHENG/2010/34603

HIGH PERFORMANCE FOR YOUR MACHINING TASKS

LMT Tools is one of the most renowned experts in the development and production of precision tools. Our passion for precision ensures that our industrial customers implement unparalleled quality at the interface between the machine and the workpiece.
We offer an extensive product range of standard and special tools focusing on milling and tapping, rolling systems, gear cutting and advanced tooling.

Exactly the best solution for your requirements.

lmt.in@lmt-tools.com
+91 2135 614960

www.lmt-tools.com

LMT • TOOLS