MFE
MATERIALS FOR ENERGY APPLICATIONS
Ideas for all

PRT
POLYMER AND RUBBER TECHNOLOGIES

KMUTNB
INVENTION TO INNOVATION

Materials for Energy Applications
Polymer and Rubber Technologies

IDEAS FOR ALL

Materials for Energy Applications
Polymer and Rubber Technologies
King Mongkut's University of Technology North Bangkok 10800, Thailand
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Contract
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MISSION

The Materials and Energy Applications Group (MfE) and The Polymer Rubber Technology Group (PRT) were first established in 2016 and 2020, respectively, with a collaboration of researchers of KING MONGKUT'S UNIVERSITY OF TECHNOLOGY NORTH BANGKOK (KMUTNB) from The Sirindhorn International Thai-German Graduate School of Engineering (TGGS), Faculty of Applied Science, and Faculty of Engineering. The groups have received continual external funding from government research agencies and private companies. The mission of the MfE group is to create develop programs in frontier research, education, and academic training focusing on polymeric composites for energy applications in Thailand. It is research to expand the frontier of knowledge leading to new scientific discoveries and deep comprehension. The PRT serves as one of the key materials research groups in KMUTNB devoted to the development and utilization of plastic and rubber technologies that foster the advancement of sustainability and manufacturing efficacy of Thailand plastic and rubber industries.

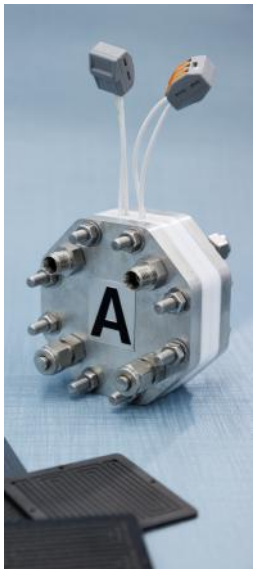
RESEARCH INTEREST

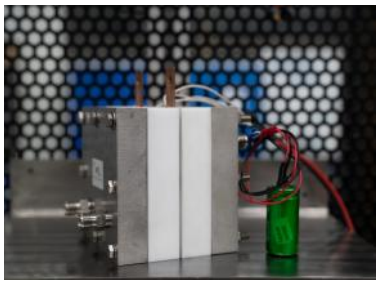
- Polymeric materials for energy applications
- Fuel cell and flow battery technologies
- Electrically / thermally conductive polymer composites
- Plastic, Bioplastic, Rubber, Processing

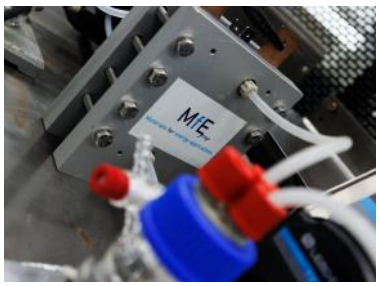
Research Description: Current research can be divided into two main activities

Fuel Cells, Redox Flow Batteries and Supercapacitor

The development of energy conversion and energy storage technologies, our research work emphasizes on synthesizing and fabricating of polymer and/or rubber components to produce bipolar plates, electrodes, current collectors, gaskets, catalysts and thermal interface materials applied to fuel cells, flow batteries, and electronic devices. Moreover, design of fuel cell and flow battery systems and their service lifespan have been investigated.







Troubleshooting in Polymer Processing

The troubleshooting in polymer processing focuses on problem solving, often applied to repair failed products or processes related to operating condition and material formulation. The polymer process of interest is relevant to extrusion, injection molding, injection blow molding, calendar and compression molding

COLLABORATIONS

- Chemical Engineering, and Waterloo Institute for Nanotechnology (University of Waterloo)
- FC-LAB Research Federation FC-LAB, FR CNRS 3539, Belfort, France
- RWTH Aachen University
- Plastics Institute of Thailand
- National Science and Technology Development Agency (NSTDA)
- National Security and Dual-Use Technology Center (NSD)
- Siam Modified Starch Co., Ltd. (SMS)
- PTT Public Co., Ltd.
- SERN Co., Ltd.
- Thai Marine Protection Co., Ltd. (TMP)
- Cobra international co. ltd.

Research and development in our group Energy and materials for energy applications developments

We study design, manufacture, test, characterize and optimize;

- Proton exchange membrane fuel cells (PEMFC),
- Direct methanol fuel cell (DEFC)
- Direct ethanol fuel cell (DMFC)
- Supercapacitor (SC)
- Vanadium redox flow battery (VRFB)
- Polysulfide redox flow battery (PRFB)

Current Projects;

- Hydrogen production, energy storage, and consumption in integrated alternative energy solutions are evaluated for their energy efficiency.
- Observation of supercapacitor impacts on PEMFC-supercapacitor hybridization performance via voltage deterioration and electrochemical processes
- Design and optimizations of ultra-lightweight bipolar plate production in PEMFC
- Fuel cell stack design for portable applications
- Fabrication of bipolar plates from thermoplastic elastomer composites for vanadium redox flow battery
- Utilizing polarization curves, analyze and track the performance of a vanadium redox flow battery.
- Analyses of porous carbon supported by biochar deiced from sugarcane bagasse as an electrocatalyst for direct alcohol fuel cells
- Development of combined supercapacitor-direct alcohol fuel cell device (SCs-DAFCs) for electric vehicles using graphene-based supercapacitor electrode materials

TEAMWORK MAKES THE DREAMWORK

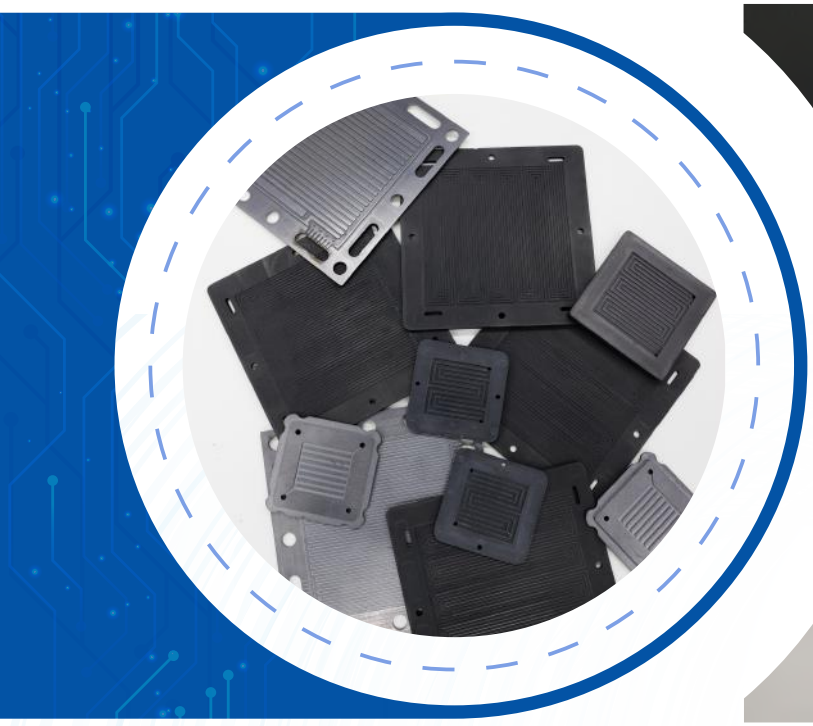
Research and development in our group
Polymer materials and Troubleshooting in Polymer Processing developments

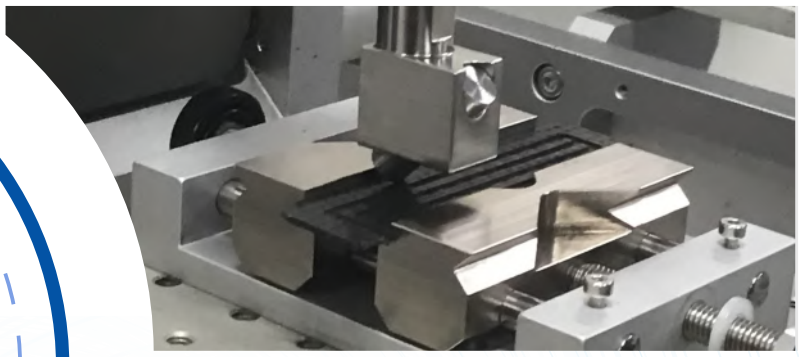
We study design of experiment, manufacture, test, characterize and optimize;

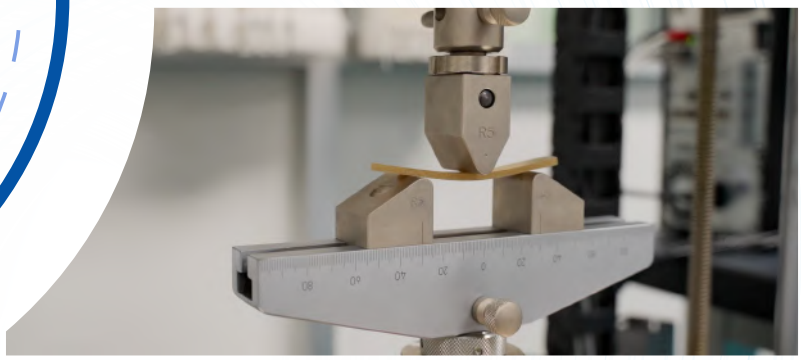
- Polymeric materials for applications
- Electrically/thermally conductive polymer composites
- Plastic processing
- Rubber materials for sustainability
- Biomaterials
- Thermoplastic starch materials
- Degradations

Current Projects;

- Data base of plastic products for Thailand plastic Industries
- Video intensive courses for plastic industry
- Fabrication of thermal interface materials from polymer mixed carbon nanotube as thermal conductive fillers for lectronic Devices and Batteries
- Development of a mobile electromagnetic sensor prototype for real time Amine concentration measurement: continuing project phase 5
- Feasibility study on microplastic degradation of thermoplastic starch/polyethylene products via the weathering tester
- Inspection of cross-link behavior of carbon fiber/epoxy composites for water sports equipment production
- Study and development factors that affect the pressing process in templates used for decorative sheet materials
- Investigation the physical properties of recycled building decorative panels and furniture
- Research and development of polymer products from natural materials
- Countermeasure of ant invasion in the plastic cap via natural additive
- Degradation behavior investigation of single-use bioplastic products
- Investigation of cost reduction for PVC sponge flooring production
- Reducing Waste of Blow Molding and Injection Blow Molding Process







Area of innovation

Who Are Our Customers?

- PTT Exploration and Production Public Company Limited (PTTEP)
- Siam Modified Starch Co., Ltd.
- Cobra international co. ltd.
- Ekko Products Co., Ltd.
- J SMITH Construction Co., Ltd.
- Crown Seal Public Co., Ltd.
- Plastic Supply Co., Ltd
- Sanakham Co., Ltd
- P. Siri Plastic Co., Ltd.
- Advance Packaging Product Co., Ltd.
- SERN Co., Ltd.
- Thai Marine Protection Co., Ltd. (TMP)

MFE Research Grants Received

- National Research Council of Thailand (NRCT)
- Thailand research funds (TRF)
- Thailand Science Research and Innovation (TSRI)
- National Science and Technology Development Agency (NSTDA)
- Program Management Unit Competitiveness (PMUC)
- Research Funds for developing high-quality research graduates in science and technology (KMUTNB + NSTDA)
- Innovation and technology assistance program (ITAP)
- Defense Science and Technology Department (DSTD)
- Shell Thailand

AWARDS

- Special Edition 2022 - Invention Geneva Evaluation Days - Virtual Event: Gold medal “Filmprotextor” (Geneva, Switzerland)
- KMUTNB Innovative Ideas 2021: First runner up “Flow battery-solar cell hybridization system”
- Advisor of innovative senior project: Innovation group: First prize, Faculty of Applied Science, KMUTNB 2021
- RI2C - Research, Invention, and Innovation Congress, 2019, The best paper award; “Experimental Study on Heat dissipative ability in recycled thermoplastic vulcanizate and reclaimed rubber composites”
- KMUTNB Invention and innovation award 2019: First prize “The production of polymer solution for making surface protective film for building”
- Shell scholarship for research in energy application 2019
- Shell scholarship for research in energy application 2017
- KMUTNB Invention and innovation award 2016: Runner-up of conceptual idea awards: The production of thermal interface materials
- KMUTNB Invention and innovation award 2014: Consolation Prize: Composite bipolar plate for PEMFC
- Outstanding worker of KMUTNB, 2005

PETTY PATENT AND PATENT

- The production of Heat dissipative thermoplastic elastomer composites for thermal interface application: Petty patent number 13131
- The production of metal sheet inserted polypropylene composite bipolar plates: Petty patent number 13322
- The production of copper coated polypropylene composite bipolar plates: Petty patent number 13323
- Automatic gas flow controller: Petty patent number 19906
- The production of polymer solution for making surface protective film for building exterior: Petty patent number 21284

PATENT (in progress)

- The production of rubber latex for making surface protective film: Patent number 2001007505
- The production of polymer solution for making surface protective film for building interior: Patent number 2001000725
- The flow battery single cell: Patent number 2101004129

PETTY PATENT (in progress)

- The production of bipolar plate from thermoplastic vulcanizate inserted with a woven carbon fiber sheet and coated with graphite sheet: Petty patent number 2103001966
- The single cell of proton exchange membrane fuel cell: Petty patent number 2103002234
- The surface and bulk electrometer: Petty patent number 2103002233

MfE Petty Patent

Silver sheet inserted PPC

Copper sheet Coated PPC

Thermal interface material (TIM)

Protective film for building exterior

Gas flow meter

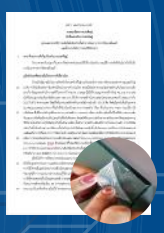
On process

Single cell flow battery

Single cell flow battery

Single cell fuel cell

Electrical conductivity



Protective film for building interior

More information please contact @MfEandPRT

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