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TEKNOLOGI
PETRONAS

UTP Research, Innovation & Commercialisation: MRC Industry Linkage Fund: Industry-University Interaction Session

UTP Capability in Serving Latex- & Rubber-Based Industries

29th June 2021

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Overview of UTP RIC Ecosystem

Mapping of MRC Priority Area with UTP Focus Area

Role of UTP in supporting industry players

Core capability under ISB

Core capability under IAS

Core capability under SSMT NEXUS



Research Innovation & Commercialization Ecosystem

Khairil Ismady
Business Development,
Centre for Advance and
Professional Education (CAPE)



Assoc Prof Dr A Rahim Othman
Director,
Research Management
Centre (RMC)

Hasiah Kamarudin
Head, Business Development



Dali Abdul Latiff Aw
Senior Director,
Technology Transfer Office (TTO)

Prof Ir Dr Mohd Shahir Liew

Deputy Vice Chancellor,

Research, Innovation & Commercialization

COUNTRY INITIATIVES
(PMII, IMII, MIII, MEMII)

RIC NEXUS (13)

**SMART
COMMUNITIES**

Assoc Prof Dr Noor Amila Wan Zawawi
Director, Institute of Self-Sustainable Building
for Smart Living



Assoc Prof Ts Dr Mohd Fadzil Hassan
Director, Institute of
Autonomous System
for Autonomous Facilities

Prof Dr Abd Rashid Abd Aziz
Director, Institute of
Transport Infrastructure
for Smart Mobility



Prof Dr Azmi Mohd Shariff
Director, Institute of
Contaminant Management
for Oil and Gas

Assoc Prof Dr Tang Tong Boon
Director, Institute of Health
& Analytics
for Personalized Care



Assoc Prof Dr Syahrir Ridha
Director, Institute of
Hydrocarbon Recovery
for Enhanced Oil Recovery

**ENERGY
SUSTAINABILITY**

Research and development

Stimulate companies' internal research and development programs. Identifying current research that might be useful for the design and development of innovative processes and potential products.



Innovation, Technology & Commercialisation

Offering home-grown innovation & technologies to accelerate company growth. Involve technology development, piloting until integration into current process and commercialisation



TTO NEXUS

Incubation Hub

Capability Building

To provide industry relevant technical **training & skill enhancement programs** to develop high skilled industry talents (upskill, re-skill, competency development etc)



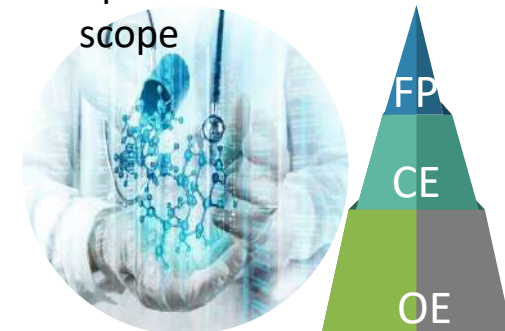
Human Capital and Talents

To ensure availability of talent in fulfilling needs from industry in relevant area. Covering from Management, Technical down to Supervisory level

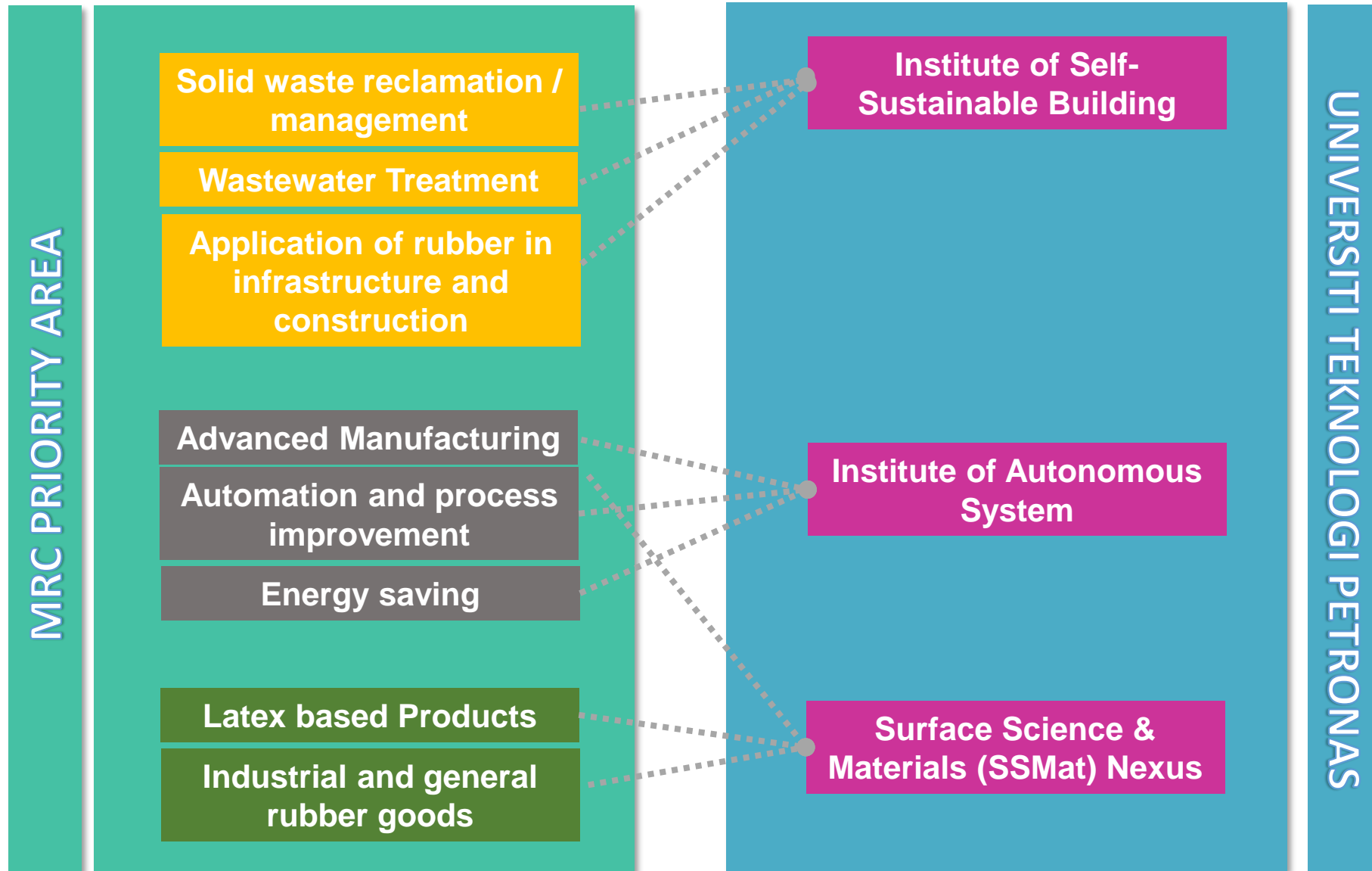


Subject Matter Expert (SME)

Access to Subject Matter Expert in various discipline to collaborate in future positioning, competitive edge and operational excellence scope



MAPPING OF MRC PRIORITY AREA WITH UTP FOCUS AREA



INSTITUTE OF SELF-SUSTAINABLE BUILDING

Assoc Prof Dr Noor Amila Bt Wan Zawawi



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SMART GREEN TECHNOLOGY

Institute of Self Sustainable Building (ISB)

Infrastructure and Construction

- Pavement Design and Evaluation
- Structural Engineering

Solid Waste Reclamation / Management

- Biomass Valorisation: energy production
- Catalyst
- Pyrolysis

Wastewater Treatment

- Physical & Chemical Treatment System
- Activated Carbon

Infrastructure and Construction

1. Incorporation of Rubber Product in Concrete & Pavement Materials
2. Utilisation of Rubber Waste for Concrete & Pavement Materials
3. Utilisation of Rubber Product & Waste to Reduce Carbon Emission in Construction Industry



**Subject Matter
Expert (SME)**

CUReS

Solid Waste Reclamation / Management

1. Incorporation of solid rubber waste with rubber seed shell to produce Activated Carbon for removal of Heavy Metals
2. Incorporating solid rubber waste with biomass waste by co-Pyrolysis techniques to produce oil and char or activated carbon
3. Catalytic and pre-treatment of rubber seed oil into diesel



**Subject Matter
Expert (SME)**

CBBR, CUReS

Wastewater Treatment

1. Physical and Chemical Treatment on wastewater or heavy metal removal
2. Environmental Engineering
3. Activated Carbon on recycling of water, particle trap and filtration bed



**Subject Matter
Expert (SME)**

CBBR, CUReS

Infrastructure and Construction

- Rubberized Concrete for Shock and Impact Absorption.
- Latex-Bitumen Emulsion for Road base & Soil Stabilisation
- Rubber Seed Oil for Recycled Asphalt Pavement
- Tyre Pyrolysis Oil Modified Asphalt Pavement
- Highway Pavement Design And Materials

Solid Waste Reclamation / Management

- Co₂ Adsorption On Modified Rubber-Seed Shell Activated Carbon **(National)**
- Co pyrolysis of waste mixtures from biomass and plastic based materials to produce lignin-based liquid for fine chemical production **(National)**
- Integrated Biodiesel Blending System For Mixtures Of Rubber Seeds Oil And Crude Palm Oil **(National)**

Wastewater Treatment

- Removal of Heavy Metals Using Sludge Derived Activated Carbon in Batch Adsorption Studies **(International)**
- Fundamental Study On Heavy Metals And Suspended Solids Removal Using Groundwater Treatment Plant Sludge (GWTPS) **(National)**
- Removal Of Heavy Metal Ions From Industrial Waste Using Activated Carbon Derived From Rubber-seed Shell
- Green based nano-composites for adsorption of heavy metals from produced water **(National)**

Infrastructure and Construction

No	Technology	TRL
1	Irradiated Waste PET-Based Semi-Flexible Pavement Surface	3
2	Irradiated Waste PET Asphalt Pavement (Plastiphalt)	3

No	Short Course
1	How Tall Building Construction Play a Significant Role in Building Economies
2	Pavement Materials: Principles and Fundamentals
3	Principles of Highway Pavement Materials
4	Fundamentals of Highway Pavement Materials
5	Advances in the Design and Materials Characterization for Asphalt Pavements

Solid Waste Reclamation / Management

No	Technology	TRL
1	Catalytic Cracking Process of Refined Rubber Seed Oil to Green Diesel	3
2	Pre-Treatment of Rubber Seed Oil through Ultrasonic Assisted Esterification Process	3
3	LENFLOC As Natural Based Coagulant For Water And Wastewater Treatment	3
4	Advanced Oxidation Process (Photofenton Process) For Highly Polluted Wastewater	3
5	Co-pyrolysis Technology to Produce Fine Chemical and Char for Chemical Industry	3

No	Short Course
1	Basic Wastewater Parameters: Analysis and Interpretation for Biological Wastewater Treatment
2	Technology Review for Wastewater Treatment: Adsorption, Photocatalysis and Membrane
3	Aerobic and Anaerobic Wastewater Treatment
4	Introduction To Environmental Studies

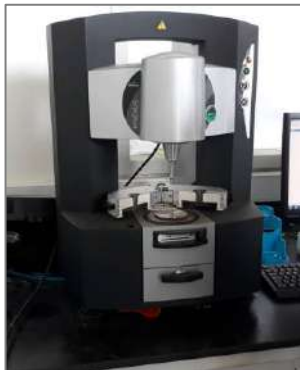
Wastewater Treatment

Infrastructure and Construction

- Concrete compression & flexural testing machine
- Asphalt Material Testing Apparatus (MATTA)
- Dynamic Shear Rheometer
- Triaxial Testing Machine
- Atomic Force Microscopy (AFM)
- Scanning Electron Microscope (SEM)
- X-ray Diffraction (XRD)



MATTA



Dynamic Shear
Rheometer



SEM

Solid Waste Reclamation / Management

- Fixed Bed Drop Type Reactor (Pyrolysis)
- Fluidized Bed Reactor (Pyrolysis)
- Microwave-Induced Reactor (Pyrolysis)
- Field Emission Scanning Electron (FESEM)
- Micromeritics Surface Area & Porosimetry (SAP)
- Fourier Transform Infrared Spectroscopy (FTIR)
- Thermogravimetry Analyser (TGA)
- High Pressure Volumetric Analyser (HPVA II)



HPVA



FTIR

Wastewater Treatment

- Jar Test Equipment
- Sequencing Batch Reactor
- Batch Reactors
- Atomic Absorption Spectroscopy (AAS)



AAS



Jar Test Equipment

INSTITUTE OF AUTONOMOUS SYSTEM

Assoc Prof Dr Mohd Fadzil b Hassan



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DIGITALISATION AS ENABLER FOR OPERATIONAL EXCELLENCE

DIGITAL SOLUTIONS FOR OPERATIONAL EXCELLENCE

Integrated and Intelligent Automation



Product, Plant, Building & Infrastructure

Smart Design & Construct



Asset Performance & Operation Performance

Smart Operation & Maintenance



Parts, Materials & Supplies

Smart Supply Chain

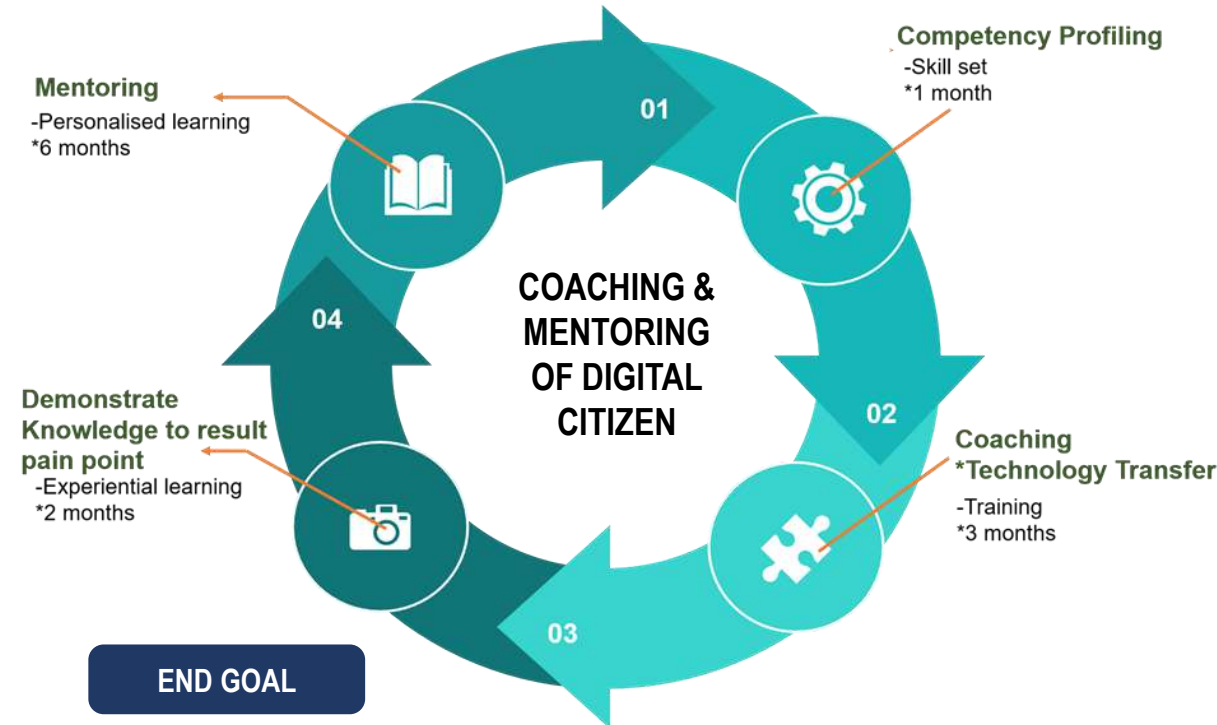


Monitoring Outcomes & SLAa

Smart Services

1. Big Data Analytics
2. Cloud Computing
3. Cyber security
4. System Integration
5. Internet of Things (IOT)

UPSKILLING & RESKILLING OF DIGITAL CITIZEN



To nurture a future-ready workforce : Building future-ready digital talents who are well-equipped with the skills required to thrive in an evolving job market

AUTOMATION AND PROCESS IMPROVEMENT



Subject Matter
Expert (SME)

**CERDAS,
HPC3,
OEC,
Positive
Computing**

1. Digitalizing Operation & Maintenance Via Artificial Intelligence (DOMAIN)
2. Advanced Diagnostic and Prognostic Technology (ADaPT)
3. Development of Intelligent Predictive Tool (i-CoRPA)
4. Automated Asset integrity and digital twinning for onshore structural facilities

Short Courses

1. Big Data Analytics for Business & Beyond
2. Big Data Predictive/Prescriptive Analytic using Python
3. Business Analytics using Power BI
4. Blockchain Fundamentals & Business Opportunities
5. Value Co-Creation using Blockchain Technology
6. Building Engaging Virtual Led Instructor Training (VILT) Environment

Upskilling Program

1. Customized short courses to upskill engineers and non-engineers to become hybrid data engineers and data analyst.
2. MSc and PhD programmes aligned with the project scope and deliverables.

ENERGY SAVING



Subject Matter
Expert (SME)

CSE

1. Plant Energy Performance Monitoring
2. Energy storage & harvesting
3. Power Electronics Converters
4. Smart Micro Grid
5. Renewable energy power distribution and convertor
6. Renewable Energy supply system
7. Multi generation grid system

ADVANCE MANUFACTURING



Subject Matter
Expert (SME)

COINN

1. Synthesis techniques
2. Analytical Techniques (Microscopy & Spectroscopy)
3. Carbon-based Materials
4. Material Development - Thin Film, Metal Oxides, Polymers
5. Device Fabrication - Patterning & Masking, Sputtering, Coating Techniques

UPSKILLING & RESKILLING

DIGITAL SOLUTIONS



RELEVANT FACILITIES



SGI Altix 4700 Supercomputer



2 units Supermicro High Computation Rack Mounted Server



- Hadoop Cluster (10-nodes)
- AMD GPGPU Cluster Computing (10-nodes)
- OpenNebula Cloud Cluster (10 nodes)



Uninterruptible Power Supply

Green Room Studio



Experiential Learning Space



Virtual Reality Lab & Facilities



SURFACE SCIENCE & MATERIALS (**SSMAT**) NEXUS

Dr Nabihah Salih



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Surface Science & Materials Nexus

A collaborative platform between universities and industries to accelerate the development, testing and applications of surface science and advanced materials

Surface Science Pillar

Adsorption,
Separation
and
Catalysis

Lubrication,
Corrosion
and Coating

Atom-level
Surface
Analysis

Molecular
Simulation

Materials Pillar

Polymers,
Rubber &
Composites

Carbon-
based
Materials

Ceramics,
Metals &
Alloys

Simulation
& Modeling

SSMAT Nexus Partners:



SSMAT Nexus is a network of advanced materials R&D capabilities, unique scientific and technical resources in high performance computing, synthesis and characterization of materials, and high-impact experimentation.

Surface Analysis

- X-Ray photoelectron spectroscopy
- Atomic force microscopy
- Scanning tunnelling spectroscopy
- Fourier transformed infrared spectroscopy
- Raman spectroscopy



Molecular/Structural Analysis

- X-ray diffraction
- FE-scanning electron microscope
- HR-transmission electron microscope
- Energy dispersive X-ray elemental analysis
- Atomic adsorption spectroscopy
- ICP-Optical emission spectroscopy



Particle/Powder Analysis

- Particle size analyser
- BET surface area analyser
- Mercury porosimeter
- Temperature-programmed desorption, reduction and oxidation

Adsorption Properties (Static)

- Zeta-potential analyser
- Liquid phase adsorption of metal and ions



Materials Processing

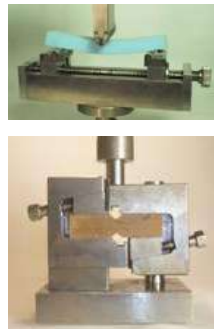
- Injection moulding
- Compression moulding
- Extrusion
- Internal mixer
- Die compactor
- Powder metallurgy press
- Jacketing and braiding machines
- Electro-spinning
- Vacuum-bagging
- Vacuum-thermoforming
- 3D printing
- Induction furnace
- Etc.



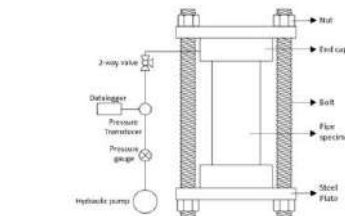
Extrusion



Universal testing machine



Burst test rig



Accelerated weathering chamber



Cyclic test

Simulation & modelling

- Altair OptiStruct
- Altair AcuSolve
- Altair EDEM
- Altair HyperMesh
- Gaussian
- COMSOL Multiphysics
- Materials Studio
- MATLAB



- UTP-Altair Centre of Excellence
- High-Power Cloud Computing



Advanced Materials

- Formulation of gloves with functionalized properties such as hydrophobic/hydrophilic characteristics, air permeable, anti-microbial and smart responses
- Surface functional analysis
- Precision in simulation/modelling of material, mechanical and functional properties of latex & rubber products



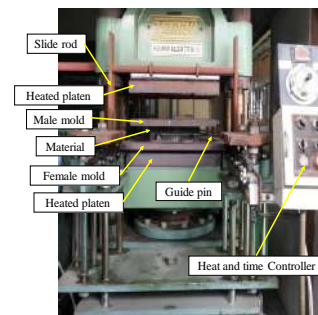
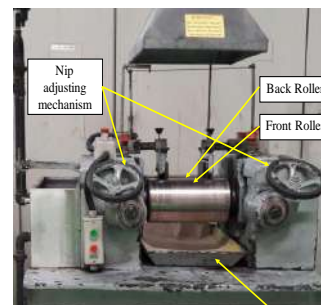
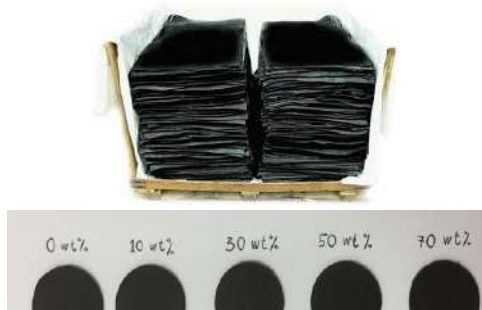
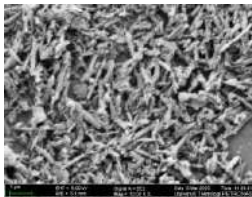
Advanced Product Development

- Sustainable and environmental-friendly latex- & rubber-based materials (with bio-based content, low life-cycle impacts)
- Development of touch screen gloves for smart devices using conductive materials



Advanced Process Development

- Development of an efficient new process with low energy/water demand and less labor intensive
- Simulation of air circulation and multi-phase flows to improve efficiency and safety of production line
- Enhancement in CAD/CAM/CAE capabilities for mould design



- UTP-Altair Centre of Excellence
- High-Power Cloud Computing

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Thank You

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