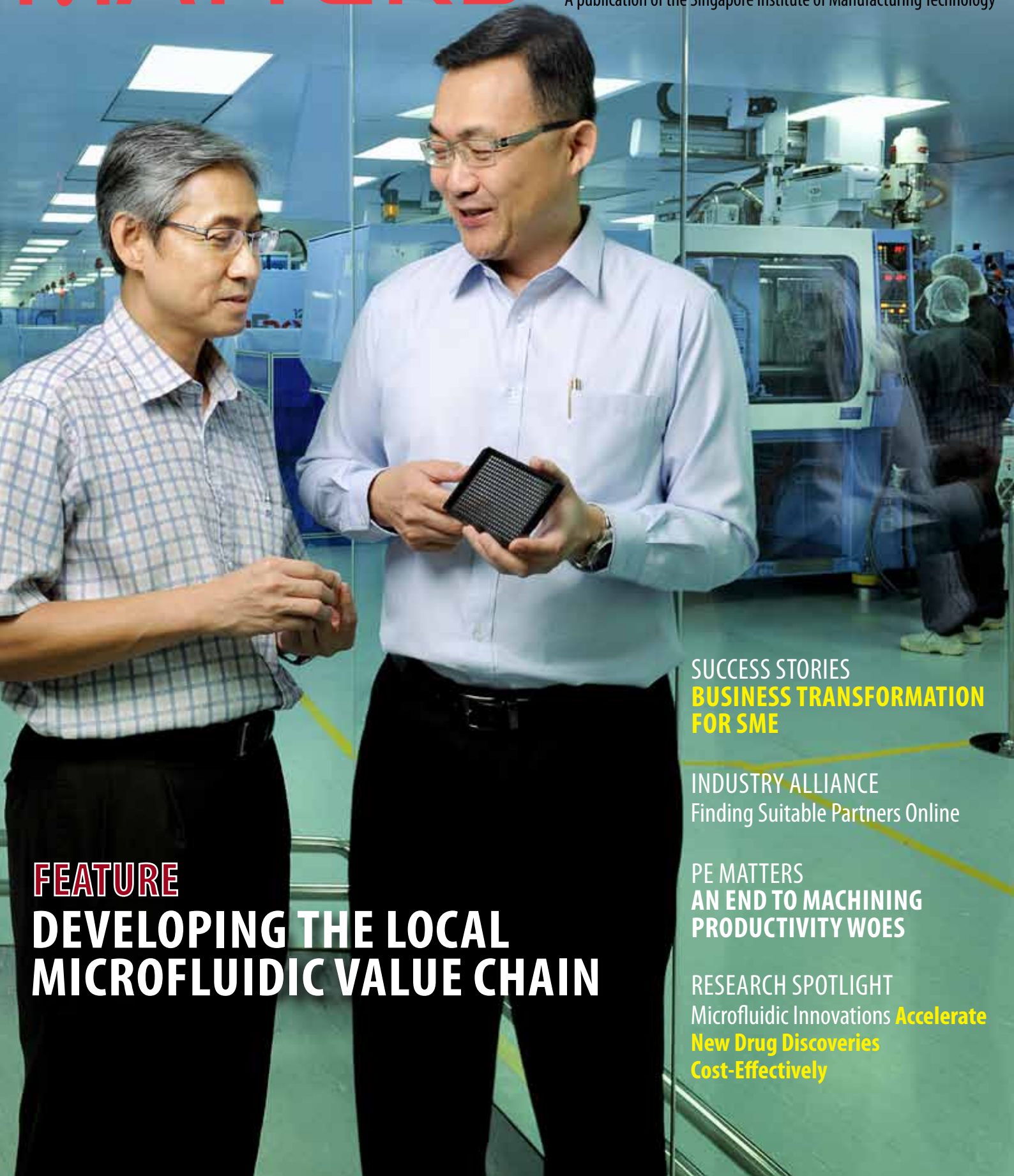


MANUFACTURING MATTERS



July 2016 | Issue 3

A publication of the Singapore Institute of Manufacturing Technology



FEATURE
**DEVELOPING THE LOCAL
MICROFLUIDIC VALUE CHAIN**

SUCCESS STORIES
**BUSINESS TRANSFORMATION
FOR SME**

INDUSTRY ALLIANCE
Finding Suitable Partners Online

PE MATTERS
**AN END TO MACHINING
PRODUCTIVITY WOES**

RESEARCH SPOTLIGHT
Microfluidic Innovations **Accelerate
New Drug Discoveries
Cost-Effectively**

NOTE FROM EDITOR...

Dear Friends and Industry Partners,

The technology to manufacture microfluidics is emerging although the microfluidic market is expected to reach US\$7.5 billion from US\$3.1 billion in 2015 with a compound annual growth rate of 19.3% in 2020 (Source: MarketsandMarkets 2015). The processes to make rigid polymer chip is based on precision plastic part production and assembly. Compared to manufacturing Silicon and Glass-based microfluidic devices, the capital investment of Micro-Electro-Mechanical Systems (MEMS)-based equipment is far higher than the polymer-based process. Soft polymer-based Polydimethylsiloxane (PDMS) manufacturing which uses soft lithography process is also less mass scalable.

Microfluidic part specifications, generally stringent, require structure size down to 10µm or lower, using mass producible plastic injection moulding. One of the unique processes for microfluidic devices manufacturing is the requirement of multiple layers or substrates bonding using thermal fusion or similar processes. The technical advantage offered by A*STAR's Singapore Institute of Manufacturing Technology (SIMTech) is the know-how of reinventing the process for stress-free moulded part and deformation-free channel sealing. The process developed is also mass scalable for production.

It is against this backdrop of available capabilities from SIMTech to make cost-effective polymer-based microfluidic devices, coupled with the market potential, that Exploit Technologies Pte Ltd which is the technology commercialisation arm of A*STAR introduced a co-funding structure to create a local manufacturing value chain for the industry to capture microfluidic market potential. (See Feature opposite for details). Do make use of it.

Swee Heng

Editor, Manufacturing Matters

Email: shlee@SIMTech.a-star.edu.sg



DEVELOPING THE LOCAL MICROFLUIDIC VALUE CHAIN

InziGn Pte Ltd is a beneficiary of the device-inspired approach

The development of the local microfluidic value chain was given a boost. Exploit Technologies Pte Ltd (ETPL), the technology commercialisation arm of A*STAR, introduced a co-funding structure for device owners to engage the local manufacturing industry. Up to 70 per cent of the total project cost is funded for device owners with project that passed the qualifying criteria, to collaborate with SIMTech Microfluidic Foundry (SMF) to build prototypes. The prototypes will be translated to design for scale-up manufacturing eventually. The scale-up partner or licensee signs a technology transfer package with SMF, aligning to SMF's manufacturing skillset and devices library. With this transfer, SMF will translate the prototype device at the site of the licensee where the manufacturing resources are available. The co-funding arrangement has helped to drive the microfluidics value-chain from device owners, SIMTech, to scale-up partners like InziGn Pte Ltd.

InziGn has an impeccable track record of serving customers in the medical industry for over 30 years. It has gained invaluable

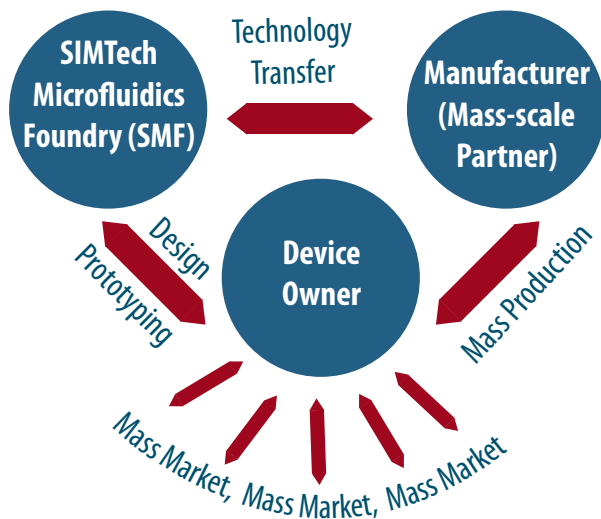
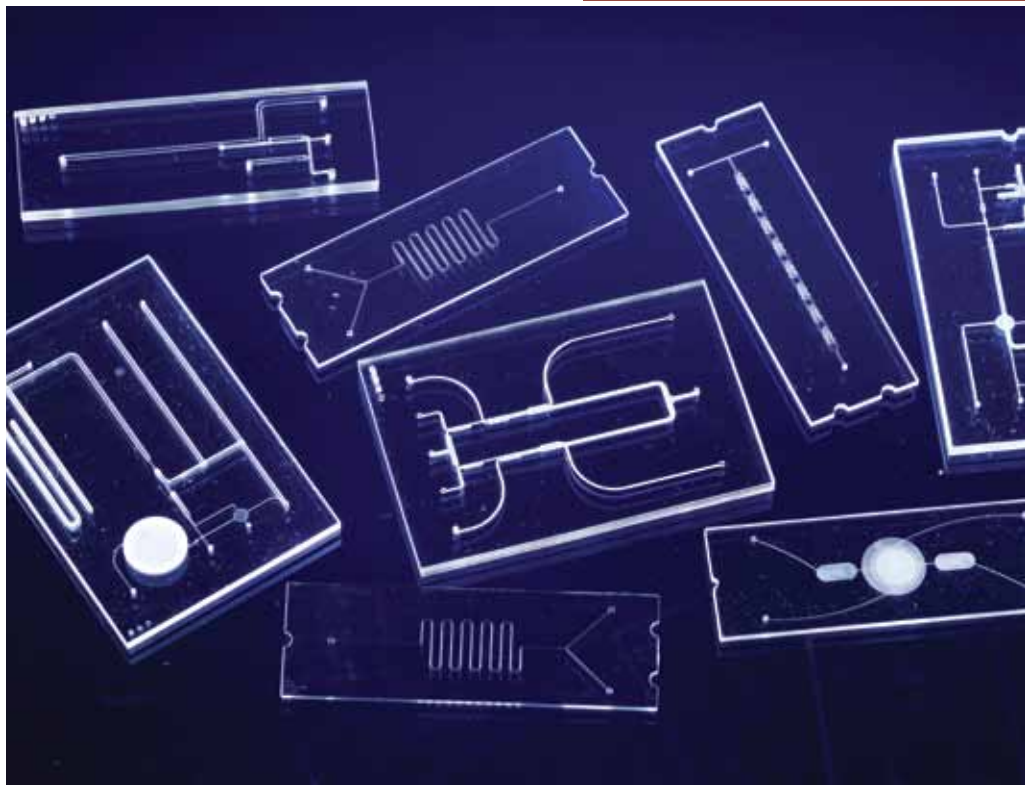


Figure 1: Microfluidic Manufacturing Value Chain Model

know-how in the design, development and manufacturing of single-use medical disposable devices. Expertise in high precision mould making, plastic injection moulding, assembly

and packaging, allows it to address the exacting needs of its customers. Inzign's customers are OEMs in the medical device, pharma and diagnostics industries, from US, Europe, Japan

“Through this continuous partnership with SIMTech, InziGn will enhance its manufacturing capabilities, expanding into mass production of complex diagnostic devices to capture value in the vast microfluidic devices manufacturing business”

Mr Phua Swee Hoe, Managing Director
InziGn Pte Ltd

and Singapore. To increase its market share, InziGn is seeking to expand its core business into microfluidic devices manufacturing.

As the preferred mass-scaling partner in the value chain development, InziGn acquired SIMTech's technology in microfluidic devices manufacturing, supported by SMF and ETPL. Through the "device-inspired" approach, SIMTech transfers the manufacturing processes based on specific process requirements and specifications of the devices. Technology transfer was successfully completed in December 2014. Since then, InziGn has expanded the production space with a new cleanroom specifically for microfluidic device manufacturing. The company is now competent in producing devices with feature size down to 50µm. It is in discussion stage to finalise the transfer package for device owner's device with high throughput bonding processes.

For enquiries, please contact
Mr Rick Yeo, Director of EAC
ricky@SIMTech.a-star.edu.sg

EAC Emerging Applications Centre
Seeding and Growing Emerging Industries



BUSINESS TRANSFORMATION FOR SME

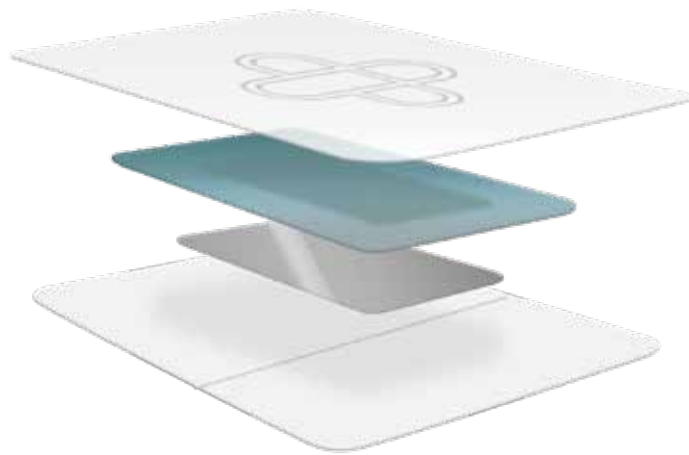
ERS Industries Pte Ltd, a third party distributor for off-the-shelf rack solutions, enrolled in SIMTech’s Operation Technology Roadmapping (OTR) when it faced increasing competition without a future plan nor a sustainable business model to rely on. The SIMTech OTR team helped ERS Industries create its roadmap by identifying its key external drivers, prioritising its future technology investments, and determining its future business direction towards being an OEM of high-value added e-rack products. The technology roadmap provided an overview of the technology required to meet ERS Industries’ various business and market needs and ensures that any technology introductions are relevant and have a direct impact to ERS Industries’ business.

“My team was skeptical at first thinking that it was just another regular programme. The OTR workshops turned out to be one of the best time and money investments we’ve had in many years”

Mr Cheong Chun Keat, CEO, ERS Industries Pte Ltd

In addition to a strategic business plan, the OTR accessed ERS Industries to relevant A*STAR technology and researchers to create the E@Rack, an energy-efficient next-generation server racks which reduce operating cost by 30 per cent. ERS Industries is now an OEM of high-value added e-rack products with 50 per cent improvement in revenue. ERS Industries invested S\$10 million to build a factory. The company has also signed up for SIMTech’s Enhanced OTR to validate its business and expansion plans annually.

For more information, please contact **Mr Jeff Pan** at sppan@SIMTech.a-star.edu.sg



SOOTHING WOUND CARE SOLUTIONS

Advanced First Aid Research (Aluminaid), a medical device company headquartered in Singapore, worked with SIMTech to develop a high thermal conductivity burn relief treatment which improves healing on burn injuries. Two different application methods are developed, a plaster type for small wounds and aerosol spray for large or irregular wounds.

In this collaboration, micro-forming process was developed to produce micro-features for enhanced thermal conductivity of very thin aluminium foil plaster type wound dressing. The foil prototype was successfully manufactured using micro-rolling and micro-stamping methods. For the aerosol solution, a spray which forms a high thermal spray conductive layer on affected burn skin with cooling effect was developed. A biocompatible aerosol spray composition was optimised for fast drying, soft-feel and easy peel-off.



The plaster type and aerosol spray wound care solutions using high thermal conductivity technologies are first of its kind

For more information, please contact **Dr Alex Thoe** at tbthoe@SIMTech.a-star.edu.sg

A*STAR Collaborative Commerce Marketplace (ACCM)



FINDING SUITABLE PARTNERS ONLINE

MNCs, LLEs and SMEs can now search for suppliers, customers and research collaborators via the A*STAR Collaborative Commerce Marketplace

The A*STAR Collaborative Commerce Marketplace (ACCM), the result of a collaboration between A*STAR and Warwick Manufacturing Group, University of Warwick to assist the local manufacturing industry, was launched by Minister of Trade and Industry (Industry), Mr S Iswaran on 12 May 2016. The ACCM is an additional avenue for business opportunities as the manufacturing industry gains insights into MNCs' or customers' requirements and is a platform to address technological shortfalls. The integrative portal documents the capabilities of local manufacturing companies and technologies provided by A*STAR RIs for Multinational Corporations (MNCs) and Large Local Enterprises (LLEs) to effortlessly match their requirements with local manufacturing suppliers. Companies can also connect with A*STAR RIs and Institutes of Higher Learning (IHLs) which can assist to bridge their technology gaps.

The ACCM also facilitates relationship building across local suppliers, MNCs,

LLEs and government agencies by creating greater business opportunities and partnerships across different sectors. It encourages companies to collaborate amongst themselves and with A*STAR RIs.

MNCs and LLEs which pilot tested the ACCM gave the thumbs up.

“ **Huge supplier base, shedding light on suppliers that we have not previously considered** ”

A Large Local Enterprise in the Aerospace sector

“ **Comprehensive identification of potential suppliers with verified manufacturing processes and skills** ”

A Medical Device MNC

“ **Standards/certification filters useful in ranking suppliers** ”

A Large Local Enterprise

“ **Fast and more targeted search on specific capability and useful filtering of companies according to their capabilities and ISO standards** ”

A MNC equipment manufacturer in Singapore

“ **Local suppliers that matched to the needs of an overseas buyer identified within a short time** ”

Overseas MNC

As a user, please register yourself and your company at <https://accm.a-star.edu.sg>.

For more information, please contact **Mr James Yip** at yipj@SIMTech.a-star.edu.sg



Scan for more information on A*STAR Collaborative Commerce Marketplace



AN END TO MACHINING PRODUCTIVITY WOES

The machining dynamics solution is a boon to companies requiring exacting precision

Like many companies, Cragar Industries Pte Ltd, a specialist in the fabrication of precision mechanical components and sub-assembly of optical and medical instruments, optimises its cutting conditions based on experience. Its engineers encountered challenges and limitations in milling special amorphous thermoplastic used in optical components for superior clarity through conventional methods.

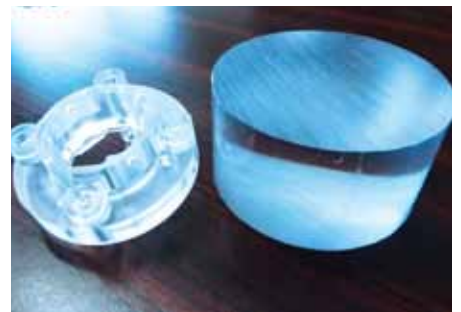
Participating in the Collaborative Industry Project on Machining Dynamics to equip companies with the necessary knowledge and tools to systematically implement SIMTech's machining dynamics analysis technology to improve productivity and quality of milling operations, Cragar Industries applied quick milling vibration solver and optimiser to its products. The SIMTech-developed easy-to-use scientific solution through solving a complex mechanism of milling

dynamics by considering the various workpiece materials and tooling used. SIMTech trained the company's managers, supervisors and process engineers on the systematic scientific approach to improve productivity. A quick milling solver developed by SIMTech was customised for the company to prevent vibration in optimal milling conditions. Consultancy and know-how of advanced milling technology was also provided.

With the scientific approach, instead of trial and error, the finishing of machined

“Cragar Industries' machining productivity woes came to an end. Machining time is reduced by more than 20 per cent”

Mr Royston Lim
Director
Cragar Industries Pte Ltd



components is improved. Cutting tools and tool spindle life are extended, machining speed increased, reducing overall operation cost.

For enquiries, please contact
Dr John Yong, Director of PE COI
msyong@SIMTech.a-star.edu.sg
Web: www.SIMTech.a-star.edu.sg/PECOI

PE COI Precision Engineering
Centre Of Innovation
Sustaining and Advancing PE Industry



Scan for more information
on Precision Engineering
Centre of Innovation



EFFECTIVE EQUIPMENT UTILISATION IMPROVES PRODUCTIVITY

Companies experience reduced machine breakdowns and scrap parts production

Twenty companies involving more than 100 participants have participated in the Overall Equipment Effectiveness (OEE) Initiative of MPTC. Company personnel were trained on the OEE Assessment & Productivity Improvement methodology to identify key losses and brainstorm ideas to improve productivity through procedural changes. Companies were also assisted on implementing an OEE System comprising a Machine Utilisation Data Acquisition (MUDAQ) system on selected machines and Backend OEE Analysis Software. For the participating companies, productivity improvements are experienced in tooling downtime to a tune of 60 per cent, machine idle time reduction of 70 per cent, and rework and defects reduced by 40 per cent. All these translate to improved throughput for the piloted machines. The OEE methodology instills a productivity culture and encourages better communications among staff.

One of the participating companies

which benefited from the initiative is Singapore Precision Engineering Quality Services (SPEQS) Manufacturing Pte Ltd. Incorporated in May 1990, SPEQS Manufacturing provides a wide range of precision engineering services to the Aerospace, Oil & Gas, Healthcare, Security and Electro-mechanical industries.

SPEQS Manufacturing implemented the OEE assessment for CNC machining, comprising MUDAQ system and OEE analysis software. Three champions were trained on OEE methodology to carry out the OEE assessment.

Arising from this initiative SPEQS Manufacturing improved its jigs, fixtures, and processes with a 33 per cent reduction in loading/unloading time from 3 to 2 minutes, yielding potential savings of 60 machine hours per week for 10 machines. For tool life management and coolant inspection of its CNC machines, 25 per cent reduction in stop for inspection time from 2 to 1.5 minutes was registered, providing potential savings of 25 machine hours per week on

“ This new implementation has helped us to improve productivity which is so important to a SME where resources are limited ”

Ron Mao
Managing Director
SPEQS Manufacturing Pte Ltd

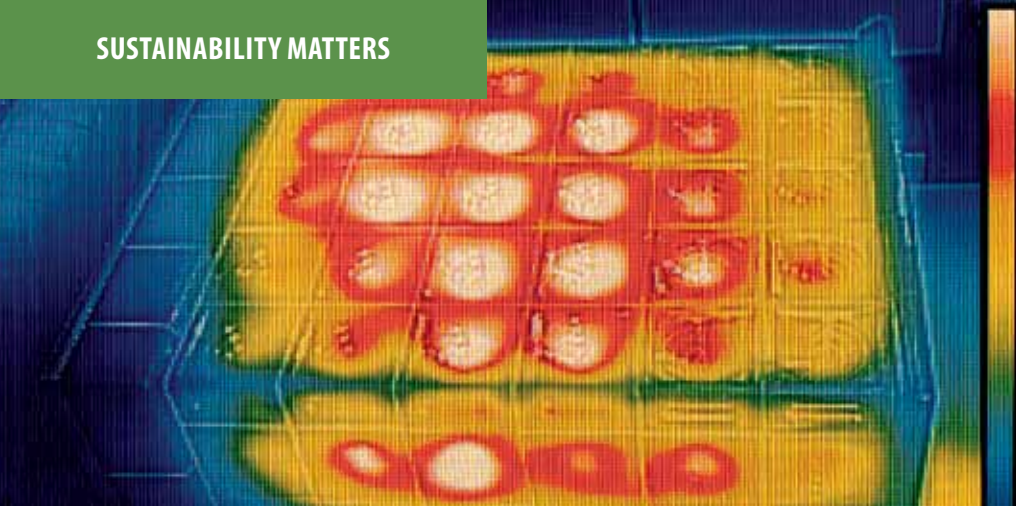
10 machines. Its shift handover time improved 33 per cent from 15 to 10 minutes, saving 10 machine hours per week for 10 machines.

For enquiries, please contact
Dr Lee Eng Wah, Director of MPTC
ewlee@SIMTech.a-star.edu.sg
Web: www.SIMTech.a-star.edu.sg/MPTC

MPTC Manufacturing Productivity
Technology Centre
Enhancing Manufacturing Productivity



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Manufacturing Productivity
Technology Centre



ENERGY EFFICIENCY IMPROVEMENT THROUGH THERMAL MANAGEMENT

Thermal management innovations reduce energy use, minimise heat loss and harvest renewable energy

The manufacturing industry can save energy costs through these ways:

Thermal Imaging locates hot spots around production lines by picking out heat leakages from small gaps in heating equipment and radiative heating from exhaust pipes. From locating precise hot spots and using thermal simulations to understand the origins and evolution of the heat transmission, heat loss can be managed to save energy. The result helped a company to retrofit its existing line, which substantially reduced heat loss. The outcomes also enabled the equipment maker to redesign a new production line for the company based on a more holistic energy efficiency perspective. The same thermal simulation technology also helped another company optimise the heating of a bio-mixer to accelerate the decomposition of food wastes.

Thermal Analysis can establish a set of systematic measurement routines to accurately diagnose thermal performance of LEDs to avoid failures or maintain performance at the desired levels. Poor workmanship in manufacturing and unfavourable operational conditions for LEDs, especially high power ones, may

reduce their reliability significantly. SIMTech has developed a Peltier-based temperature controller to analyse LEDs performance at various temperature regimes (Figure 1).



Figure 1: Peltier-based thermal performance analyser

Energy Harvesting of solar energy to cool the work place or shop floors conserves energy. In a Collaborative Industry Project with four companies, SIMTech developed an air cooler using thermal electric cooling (TEC) material, driven by a Direct Current (DC) from photovoltaic cells. When the TEC is driven by a DC bias, one side is heated up, while cooling the other side which can be used to generate cool air to ventilate the room (Figure 2). To maximise the cooling, the heat generated at the hot end needs to be removed, without consuming additional energy. This is

achieved with an innovative design of a heatsink assembly using natural thermal convection (Figure 3). Currently, the prototype is being scaled up for site implementation.

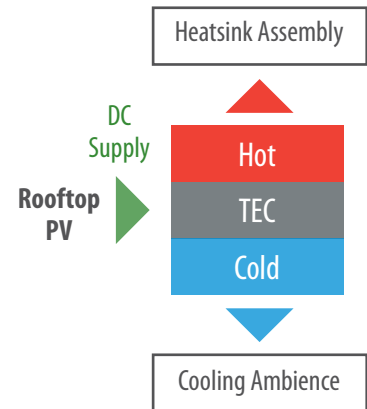


Figure 2: Cooling ambience with renewable energy powered thermal electric cooler

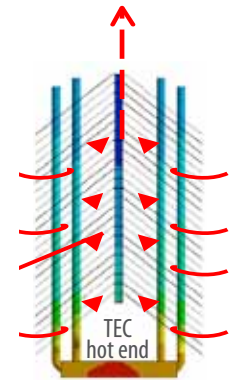


Figure 3: The tubes transfer heat from the hot end of the TEC, which create a temperature difference around the aluminum foil surfaces. This heats up the air near the surface of the foils, which rises, and drags in cooler air from the surrounding

Programmes and Funding of SIMTech's Thermal Management CIP assists manufacturing companies to address heat loss generated into the shop floor. For this CIP, SMEs are eligible for ICV and CDG Lite. MNCs are supported under the Energy Efficiency Monitoring, Analysis and Planning for Solutions (E2MAPS), jointly developed with the Employment and Employability Institute.

For enquiries, please contact **Dr Chen Wei Long**, Director of SMC
 wlchen@SIMTech.a-star.edu.sg
 Web: www.SIMTech.a-star.edu.sg/SMC

SMC Sustainable Manufacturing Centre
 Embracing Sustainable Manufacturing



Scan for more information on Sustainable Manufacturing Centre

MICROFLUIDIC INNOVATIONS ACCELERATE NEW DRUG DISCOVERIES COST-EFFECTIVELY

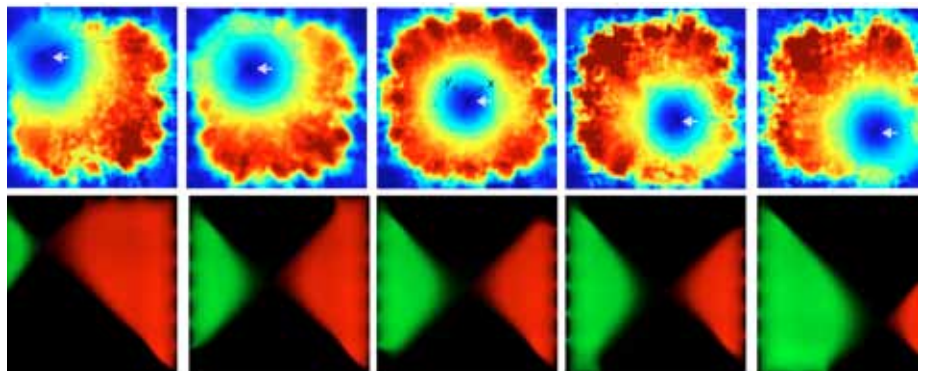
This is achieved through the SIMTech-developed miniaturised assay or cell culture system which helps biologists create accurate cell migration models

Current laboratory assays only measure end-point cell migration data, shedding little insight into how cells respond to drug concentration changes in real-time. This information is critical in creating accurate cell migration models which will substantially reduce the enormous time and cost of developing new drugs.

“**The unique assay has allowed us to study how cells move towards nutrient sources more effectively. It has also been enabling us to easily collect more data than we could previously imagine**”

*Dr Chiam Keng Hwee, a biophysicist from the A*STAR's Bioinformatics Institute, who has recently started using the miniaturised assay*

In creating accurate cell migration models, the miniaturised assay which allows rapid drug concentration changes to be delivered directly to cells, eliminates errors associated with slower



(Top) Movements of the virtual fluid well being focused and moved (traced by white arrow)
(Lower) Fluorescence measurement of concentrations (green and red) being moved on-demand, by the virtual well. Scale bar in picture represents 200 μ m

delivery mechanisms in conventional assays. The miniaturised assay, consisting of microchannels narrower than a human hair, generates a virtual fluid well in which drug concentrations can be directly delivered to cells, much like how a spotlight can be moved and focused.

While the miniaturised assay is in first-stage trials, researchers are already seeing improvements in the quality of cell migration data obtained. The next stage of the research will focus on comprehensive cell migration models for drug discovery in cancer and inflammation.

Dr Chiam Keng Hwee from A*STAR's Bioinformatics Institute, Prof Charles Yang from the Nanyang Technological University and Prof Nguyen Nam-Trung from Griffith University are also contributors to this work.

The work and findings have been published in the scientific journal *Lab on a Chip* in January 2016. *Lab on a Chip* ranks in the top 10 of the Royal Society of Chemistry's family of journals.

For enquiries, please contact Ms Toh Guek Geok, Alicia at ggtogh@SIMTech.a-star.edu.sg

Events were organised in 2016 to engage the industry and forge partnerships

PE COI Annual Conference 2016, 12 May



Minister S Iswaran was the Guest-of-Honour for PE COI Annual Conference 2016

Graced by Minister for Trade and Industry (Industry), Mr S Iswaran, the event was organised by SIMTech, in collaboration with the Singapore Precision Engineering and Technology Association (SPETA). Four new initiatives and activities to boost the competitiveness of the local PE companies by developing their capabilities were announced at the event.

The ACCM e-portal highlights the capabilities of local SMEs so that MNCs and LLEs can easily source for prospective suppliers in Singapore. The platform enables SMEs to gain insights to the needs of MNCs and LLEs. Through this network, companies with similar interests can better connect with each other, and to A*STAR research institutes or universities that can help them bridge technology gaps. (Details of ACCM can be found in page 5)

A new Memorandum of Understanding (MOU) between SIMTech and SPETA was signed for SPETA members to accelerate and scale-up their adoption of technology. To grow additive manufacturing capabilities among SMEs, SIMTech also inked an MOU with five SMEs under a new additive manufacturing Collaborative Industry Project (CIP) initiative.

A joint R&D collaboration between SIMTech and Applied Materials, Inc to develop key technologies in additive manufacturing was also announced.

With the theme, Partnerships in Capabilities Development, the event was attended by 275 participants. Leaders from government agency, industry and technology experts such as Mr Ralph Foong, Director of Precision Engineering, Economic Development Board; Dr Nag Patibandla, Managing Director (Advanced Technology) Office of the CTO, Applied Materials Inc; Mr Jordon Chee, CEO of Moveon Technologies; and Dr Zheng Guoying, Director, Engineering of ST Aerospace among others, shared on the trends of the PE Industry, successful partnerships with SIMTech and the requirements of the aerospace LLE with the attendees respectively.



Signatories of the MOU for Additive Manufacturing Collaborative Industry Project



Minister S Iswaran was briefed on one of the successful PE COI collaborations

Collaborative Industry Projects (CIPs) are cost-effective R&D platforms, where companies facing similar issues work jointly with SIMTech, to develop manpower and technology



Item Management and Tracking System

20 July 2016, 18 August 2016 & 19 September 2016

This CIP aims to help companies deploy a RFID/barcode based Inventory Tracking System (ITS) to better manage, track and stock take their Inventory to improve productivity, traceability and minimise errors.

For enquiries, please contact **Mr He Wei** at: whe@SIMTech.a-star.edu.sg

Overall Equipment Effectiveness Monitoring System (OEE-MS)

Call for Participation

This CIP aims to help SMEs deploy an integrated OEE monitoring system to maximise the utilisation of their critical machines by monitoring the machine effectiveness (in terms of availability, performance & quality) on the shopfloor. Through a real-time dashboard, shopfloor managers have better oversight on all machine production activities.

For enquiries, please contact **Mr Wong Ming Mao** at mmwong@SIMTech.a-star.edu.sg

Project Resource Tracking

Call for Participation

This CIP aims to use RFID technology and mobile devices with GPS to provide a cost-effective solution for companies to better manage the process and costs of their projects by providing accurate and timely identification and tracking of actual resource used.

For enquiries, please contact **Mr Wong Ming Mao** at mmwong@SIMTech.a-star.edu.sg

Maintenance Management System (MMS)

Call for Participation

This CIP aims to enhance productivity and competitiveness for SMEs, especially in engineering service, construction and high value equipment manufacturing environment for better management of the maintenance activities and information. MMS can reduce machine downtime, maintenance costs, analysis time and provide quick maintenance decision support.

For enquiries, please contact **Mr Wong Ming Mao** at mmwong@SIMTech.a-star.edu.sg

Engineering Design for Manufacturing

Call for Participation

This CIP aims to help companies develop capabilities in engineering product design assessment for Engineering Design for Manufacturing objectives.

For enquiries, please contact **Ms Wan Siew Ping** at spwan@SIMTech.a-star.edu.sg

3D Additive Manufacturing Capabilities of Metal and Polymer

Call for Participation

This CIP aims to design, develop, and test incremental micro/nano hot embossing system for functional applications on planar parts, micro form rolling surface texturing system for friction reduction on cylindrical parts, and micro rolling system for thermal conductivity enhancement of thin metallic foils.

For enquiries, please contact **Mr Tan Lye King** at tanlk@SIMTech.a-star.edu.sg

Advanced Machining Dynamics Analysis Technology

Call for Participation

This CIP aims to develop laser surface texturing process and transfer the laser produced micro/nano surface textures onto the components and products to generate new and/or improve functional performance.

For enquiries, please contact **Dr Mehrdad Zarinejad** at: mehrdad@SIMTech.a-star.edu.sg

Annual Manufacturing Forum 2016 (AMF'16)

13 July 2016 | 8.30am-4.30pm | Grand Copthorne Waterfront Hotel Singapore

In its 11th edition, this year's AMF features Lightweight Materials and Technologies: Trends, Applications and Opportunities for Manufacturing. Join us to learn from industry key players and technology leaders on the state-of-the-art and future lightweight technologies in their respective domains and how these can be captured into creating value for your company. Relevant technologies to assist your company are showcased.

For enquiries, please contact **Ms Samantha Chan** at samantha@SIMTech.a-star.edu.sg

Emerging Applications Centre Annual Conference 2016

25 August 2016 | 8.00am-5.00pm | Matrix, Breakthrough, Discovery and Creation Theatres, Level 4, Biopolis Singapore

With the theme, Lab-on-a-chip Technology for the Biomedical Sector - Advances & Opportunities, this highly lucrative R&D-intensive market is presented. An array of microfluidics/lab-on-a-chip technologies, services, products and related businesses as well as SIMTech Microfluidics Foundry (SMF) competencies will be exhibited.

For enquiries, please contact **Ms Lin Jiamin** at linjm@SIMTech.a-star.edu.sg



Scan for more events

PE WSQ Specialist Diploma in Precision Engineering

Module 1: Employ Laser for PE Industry

25 July 2016 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Graduate Diploma in Advanced Welding Technologies

Module 1: Design Arc Welding

26 July 2016 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Implement Fundamentals of Corrosion and Corrosion Prevention

28 July 2016 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Operations Management Innovation Lean Improvement Towards Excellence (OMNI-LITE)

1 August 2016 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Graduate Diploma in Metal Manufacturing Processes

Module 1: Evaluate Advanced Metal Machining Techniques

2 August 2016 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Graduate Diploma in Manufacturing Operations Management (MOM)

Module 4: Advanced Planning and Scheduling

22 August 2016 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Graduate Diploma in Mechatronics

Module 4: Apply Industrial Robots and Automation

29 August 2016 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Graduate Diploma in MedTech Manufacturing

Module 4: MedTech Manufacturing and Supply Chain Management

5 September 2016 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Graduate Diploma in Precision Measurements and Characterisation (PMC)

Module 1: Geometric Dimensioning and Tolerancing

6 September 2016 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Operations Management Innovation Lean Improvement Towards Excellence (OMNI-LITE)

6 September 2016 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Graduate Diploma in Advanced Welding Technologies

Module 2: Implement Laser Beam Welding

15 September 2016 | 6.30pm - 9.30pm, Fusionopolis Two

For course details and registration, please visit <http://kto.SIMTech.a-star.edu.sg>

For general enquiries, please email to kto-enquiry@SIMTech.a-star.edu.sg



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About SIMTech

The Singapore Institute of Manufacturing Technology (SIMTech) develops high-value manufacturing technology and human capital to enhance the competitiveness of Singapore's manufacturing industry. It collaborates with multinational and local companies in the precision engineering, medtech, aerospace, automotive, marine, oil & gas, electronics, semiconductor, logistics, and other sectors.

SIMTech is a research institute of the Agency for Science, Technology and Research (A*STAR). With a pool of more than 400 researchers, we are committed to serving the manufacturing industry to develop the human, intellectual, and industrial capital in Singapore.

