

MANUFACTURING MATTERS

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Feature

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Little Flow Resistance,
No More Bubbles

NOTE FROM EDITOR...

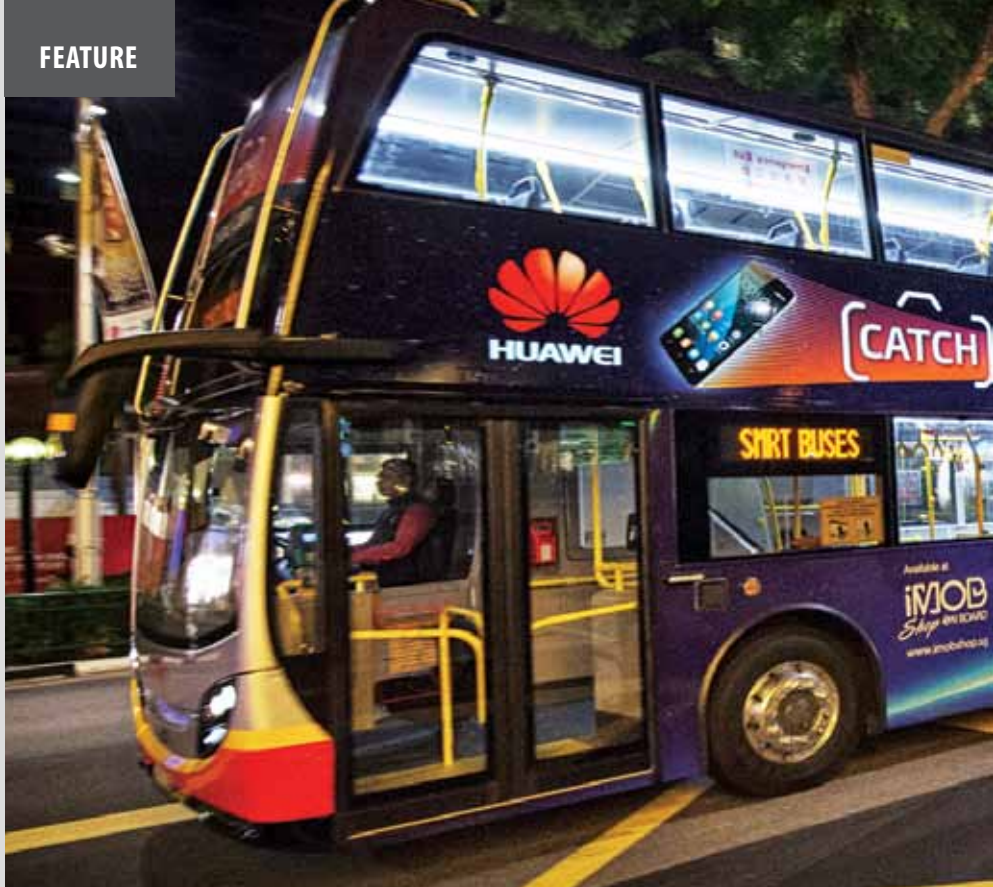
Dear Friends and Industry Partners,

Today's business environment is a difficult one. To overcome this, enterprises can differentiate from their competitors through unique offerings made possible with the use of technology. A case in point is Smart Packaging using Large Area Processing technology (see Feature). Other exciting applications using this technology have been implemented by the Emerging Applications Centre (EAC) of SIMTech with its partners. The art installations at the South Beach Club; directional displays at iLight Marina, printed lighting for art display and large advertising panels on double decker bus are some varied examples. Being explored are the multiple uses in furniture and interior designs.

The possibilities are endless...and the EAC is reaching out to industry to generate awareness and working with industry partners to realise these by building capabilities via Collaborative Industry Projects. The EAC is working to increase the applications space and to establish a base of potential users for printed lighting by collaborating with Print & Media Association Singapore, Singapore Furniture Industries Council and Building & Construction Authority.

Take the first step to know more...

Swee Heng



ENDLESS POSSIBILITIES IN EMERGING APPLICATIONS

The Emerging Applications Centre assists industry to realise these through Large Area Processing technology

SIMTech's capabilities in depositing, curing and packaging functional inks on rolls of thin, lightweight and flexible films benefit companies from novel continuous **printed lighting for illuminated advertisements** on vehicles and multi-function enabled **smart packaging**.

Printed Lighting Advertisement

SIMTech collaborated with local SME, Film Screen, to implement large-size printed lighting on vehicles, opening up new lighted advertisement options in Singapore. The Large Area Processing technology enables Film Screen, a print technology specialist in Out-Of-Home print advertisements and Point-Of-Sale props and displays, to achieve the world's first 12m² continuous printed lighting film implemented on a double-decker bus as a medium of advertisement for brand enhancement.

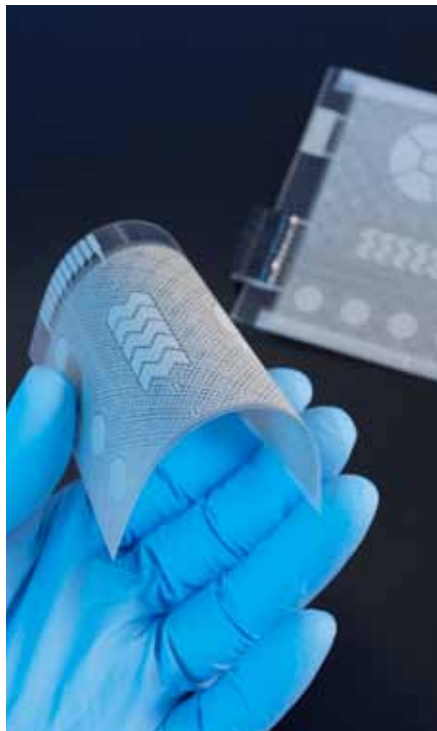
In helping Film Screen to adopt the technology for the novel illuminated advertisement, ETPL (Exploit Technologies Pte Ltd, a technology



transfer arm of A*STAR) facilitated the development of a large area inverter that could power the large area of printed lighting required for the bus. SIMTech resolved technical issues and power supply requirements for the printed lighting installation on the exterior of vehicles, improving the ease of application and reliability of printed lighting on vehicles. With these developed capabilities, Film Screen ventures into the untapped market for illuminated large size advertising, offering the company first-to-market advantages.

“ This technology brings advertisers new options to elevate and add dimensions to their out of home advertising campaigns. Developing this new format with SIMTech and SMRT Media has been a dynamic partnership ”

Mr Lee Chee Yong, Managing Director, Film Screen



Smart Packaging

In another application, the smart packaging market is expected to grow to more than US\$1.45 billion in the next decade. Such innovations are enabled by Printed Electronics technologies which include printed lighting, printed antenna for Near Field Communication, touch and system/functional integration in smart packaging.

Despite the vast market potential of smart packaging, the local industry faces difficulties to create sustainable smart packaging products. Not having sufficient knowledge in printed electronics and smart packaging design that works for customers is another major constraint. The lack of experienced integrators that can provide total solution in smart packaging and insufficient expertise of industry to combine effective marketing strategy to maximise the impact of smart packaging are real challenges.

To address these, the CIP on Smart Packaging using Printed Electronics was launched for the packaging and printing industries, industry associations, system or software solution providers and integrators to build capabilities across

the supply chain to capture value in smart packaging. CIP is cost-effective for groups of companies in a specific supply chain to work jointly with SIMTech in R&D to develop manpower and technology to address similar issues. Eight MNCs and SMEs from the printing and packaging industry and brand owners are participating in this CIP. The participating companies are funded by SPRING Singapore, e2i and PACT.

“ The CIP gives us the opportunity to explore new direction and applications in our packaging design. We hope to be the first few in the local market to design and produce smart packaging using this approach ”

Ms Serene Ler, General Manager, Starlite Printers (Far East) Pte Ltd

From the CIP, participating companies acquire knowledge in design guideline application of printed electronics; generate ideas and finalise prototype design; develop smart packaging product with printed electronics that works for their customers; learn and optimise the integration of printed electronics as well as understand cost modelling of printed electronics application to be able to price the smart packaging product effectively to their customers.

For enquiries, please contact
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EAC Emerging Applications Centre
Seeding and Growing Emerging Industries



Scan for more information on Large Area Processing Programme



CAPTURING NEW VALUE IN AEROSPACE INDUSTRY

WELDING FOR SUCCESS

Welding qualifications are pre-requisites for companies providing welding services to the Marine, Oil & Gas and Offshore industry.

Five Precision Engineering SMEs successfully completed the Welding Qualification Development Programme, fulfilling stringent requirements in welding qualifications to serve the industry. An effective methodology was developed to enable the companies to acquire and maintain welding qualifications. Participating companies' personnel are trained in controlling welding procedures for various welding techniques.

Through the training, companies fully understand the welding qualification process, strengthening their technical capabilities to improve their weld quality and capture new business

In working with the companies, SIMTech assisted a service provider of marine engine components to qualify several welding techniques. In another success story, a Precision Engineering machining SME, on completion of the training, was accepted by a MNC to fabricate valve components. A sheet metal company, planning to extend its business to the Oil & Gas and Offshore industry after the training, acquired its first qualification on stainless steel welding from Det Norske Veritas (DNV), an international certification body and classification society.

For more information, please contact **Dr Sun Zheng** at 6793 8594 or email to zsun@SIMTech.a-star.edu.sg

Proway Engineering Plastic Pte Ltd, set up in 1991, manufactures plastic parts and tools for the electronics industry. In 2013, it is one of the 4 SMEs involved in the Collaborative Industry Project to develop polymeric cabin parts, previously sourced from overseas suppliers, for a well-known airline engineering company.

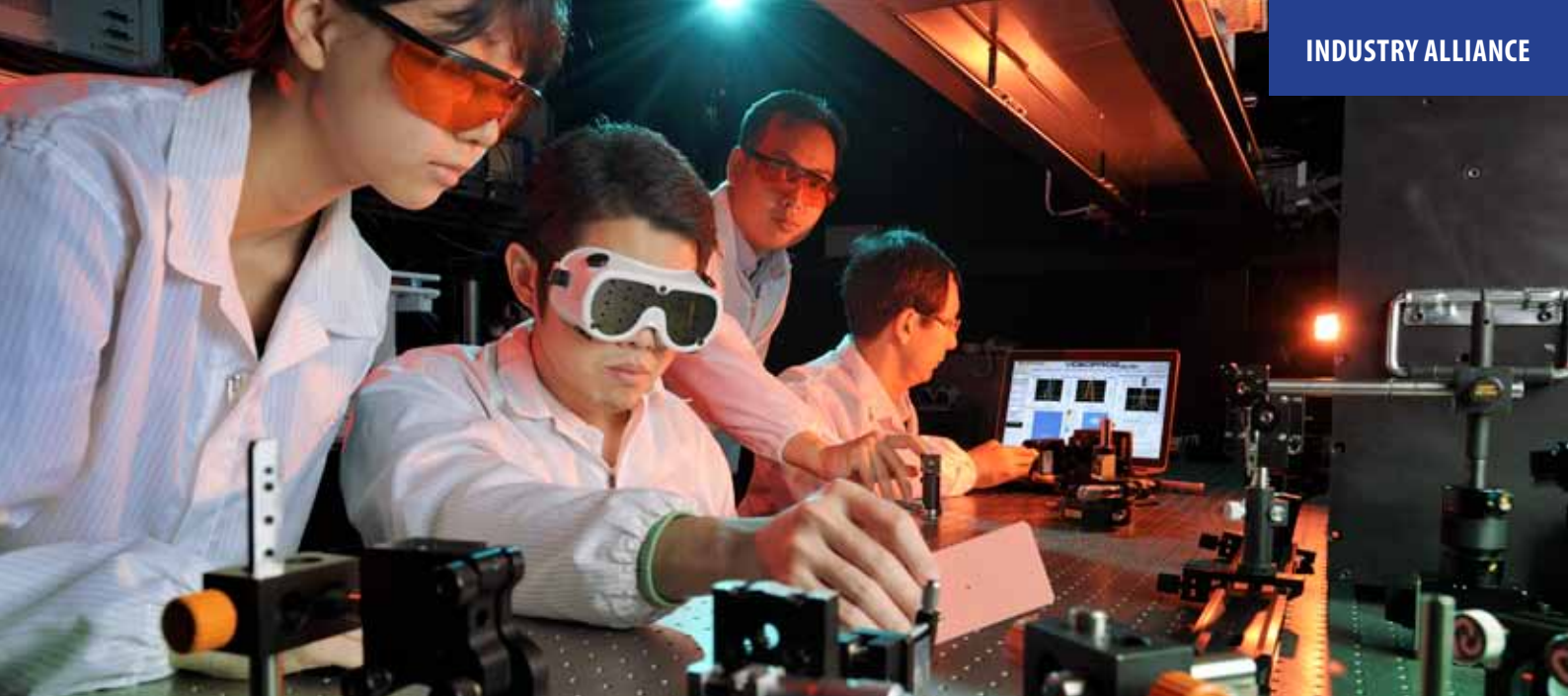
During the project, SIMTech through the PE COI provided the knowledge and expertise to upgrade the capabilities of Proway Engineering in design, simulation, and manufacturing of polymeric materials according to aerospace standards to build the company's capabilities in product design. Insert-moulding technologies were also transferred to fabricate aircraft interior parts. With these capabilities, the participating SMEs are qualified local suppliers, venturing into the aerospace industry with high value added products.

After acquiring the capabilities, Proway Engineering has secured more projects and their 2014 revenue has increased by 30 per cent and is set to expand its business overseas.

“ When the design process is controlled, the manufacturing costs can be adjusted. This will help us as we compete with other companies in the region ”

Mr Vincent Chew, General Manager,
Proway Engineering Plastic

For more information, please contact **Dr Sun Zheng** at 6793 8594 or email to zsun@SIMTech.a-star.edu.sg



BOOST FOR INDUSTRY TO HIGH VALUE MANUFACTURING

R&D engineers and manufacturing professionals are being trained to meet future higher value activities of industry through two programmes

The manufacturing industry, a key pillar of Singapore's economy, needs fresh graduates skilled and experienced in industrial R&D and project management. At the same time to stay competitive, manufacturing SMEs need to strengthen R&D activities to offer innovative products and services including productivity improvement through technology innovation.

The **SIMTech R&D Certificate Programme** aims to address these gaps. Trainees specialise in a technology in the areas of manufacturing process, manufacturing automation, manufacturing system and emerging applications. The two-year programme

To gain practical experience, trainees are attached to industry in the second year, leading to company employment in the third year, if trainees are suitable

comprises training in work skills such as effective problem solving; research tools and knowledge enrichment; an R&D project under SIMTech mentorship.

The **A*STAR-Warwick Engineering Doctorate (Eng D) Programme** avails high calibre professionals capable of creating innovation and leading a team to generate innovative solutions to complex engineering problems for industry. Industry can benefit from graduates with both the engineering and management perspectives of industry. The graduates specialise in manufacturing process, manufacturing automation, manufacturing system and manufacturing integration.

The four-year programme consists of technical and business taught modules in the University of Warwick for two years and research projects in SIMTech in the remaining two years. The doctoral degree is awarded upon the completion of taught modules and a portfolio of

These graduates benefit the industry as high calibre technical professionals and technical leaders or entrepreneurs

projects that develop a prototype or a methodology to solve engineering problems with innovations.

*For more information on the **SIMTech R&D Certificate Programme**, please contact alicekoh@SIMTech.a-star.edu.sg*

*For more information on the **A*STAR-Warwick Engineering Doctorate (Eng D) Programme** and matching research areas and supervisors, please contact yzhang@SIMTech.a-star.edu.sg*



Scan for more information on SIMTech Knowledge Transfer Office



LOCAL SME - A MEDICAL INSTRUMENT ORIGINAL DESIGN MANUFACTURER

Fong's Engineering & Manufacturing successfully ventures into the medtech sector

Despite the market potential, the strict regulatory compliance of the global MedTech industry poses challenges for local SMEs to diversify into. Undeterred, Fong's Engineering & Manufacturing Pte Ltd began this journey.

Formed in 1983 and one of the leading Precision Engineering companies in Singapore, the company provides precision machining and assembly services for High-End Mechanical, Electro-Mechanical and Opto-Mechanical components and modules or systems in the past decades for the Aerospace, Electronics and Optics Industries in Singapore and overseas. In recent years, Fong's Engineering is expanding its manufacturing services to the MedTech industry and has established ISO-13485. It engaged SIMTech PE COI senior consultant, Mr Chikashige Kiyoshi, to assist in the design and development of a medical instrument.

Chikashige played a major role in liaising with Fong's Engineering's overseas customers in major and emerging markets during the clinical trials and

“ As a result of the collaboration, the company has planned to recruit 20 staff for R&D and manufacturing operation. Working in close partnership with SIMTech, Fong's Engineering has committed over S\$3 million in the next few years to commercialise this product and expand their ODM activities ”

Mr Jeremy Fong, Managing Director, Fong's Engineering & Manufacturing

evaluation. SIMTech's consultancy has helped Fong's Engineering to expedite the preparation process for product commercialisation.

Arising from this collaboration with SIMTech, Fong's Engineering technology know-how and its staff skill set in MedTech device design and manufacturing strengthens. Six engineers in the areas of design, process and QC have been trained. This enables the company to establish a core team to uplift the company's competency from build-to-print to original design manufacturing successfully. The engineers have been guided and trained systematically

in design procedures, taking into consideration manufacturability and productivity, ease of assembly, ease of maintenance and costing down for production. With the available capabilities and expertise, Fong's Engineering is aspiring to move up the value chain as an Original Design Manufacturer (ODM).

For enquiries, please contact

Dr John Yong, Director

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



Scan for more information
on Precision Engineering
Centre of Innovation



FIT FOR SMEs

No more tedious paperwork to manage field workers

The workers of CYC Movers, a specialist in the provision of international and domestic relocation solutions for families and organisations, freight, warehouse solutions, last mile deliveries and reverse logistics, are constantly on-site carrying out their responsibilities. To record the attendance of over 20 workers at various sites, the company previously used a paper-based timesheet system. These records are then sent to the human resource team to compute the staff wages, including overtime pay. This task can take up to 15 hours a month.

Combining RFID with smart phone technology, FIT enables companies to efficiently track the attendance of workers anytime, anywhere, improving productivity by eliminating manual paper recording and data entry. FIT provides a fast and easy way to trace attendance record, eliminating the 2-hour monthly attendance verification. As there is no longer a need to spend another 2 hours to key in data, the work process is now more efficient, with improved resource allocation and simplified payroll



RFID Field Worker Identification and Tracking (FIT) is one of many ready-to-go solutions that SIMTech developed to help SMEs improve productivity. It is fast gaining adoption in multiple sectors in the engineering services, construction and general manufacturing industries

processing. The improved accuracy of attendance data reduces the number of payroll processing and overtime claim errors.

The impact of FIT extends beyond payroll processing accuracies. CYC Movers can constantly monitor the resources in the work flow to avoid any deviations. The services to important clients can now be monitored closely, enhancing deliveries. With the reliability of the services improved, more new customers can be gained. The historical data is useful to estimate the manpower costing for each project and the attendance data can be used to support analysis of labour productivity issues and improve manpower resource allocation.

For enquiries, please contact
Dr Lee Eng Wah, Director
 Email: 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



THE WONDERS OF POWDER INJECTION MOULDING TECHNOLOGY

Dynacast Singapore set up its PIM laboratory and production line in 2013. The company aspires to become one of the largest global PIM parts producer within the next 5 years

Powder Injection Moulding (PIM) is a process which combines the advantages of plastic injection moulding and the material versatility of conventional powder metallurgy. It is best used for relatively small and complex components in high volume.

The strengths of PIM, taking steel components as an example, in comparison to casting and machining process, are many.

It can be used to produce bi-layered components that combine different

material properties such as magnetic and non-magnetic, soft and hard, without involving any joining processes. PIM extended the process of traditional plastic injection moulding to high performance materials such as stainless steel, tungsten, titanium, copper, and ceramics including specialised materials ranging from super-alloys to precious metals and composites.

PIM is a near net shape manufacturing process. Similar to casting and forging, the material wastage is almost negligible. For a component that

The advantages of PIM in comparison to casting and machining process

	PIM	Die Casting	Machining
Density	Variable up to 98%	95 to 98%	100%
Surface Finish	0.4 to 2µm	3 µm	0.4 µm
Part Complexity	high	medium	low
Design Flexibility	high	high	low
Suitable Production	high volume	high volume	low
Material Range	high	low	medium
Part Strength	medium	low	medium
Material Wastage	Very low	Very low	Very high

Today, this widely recognised established process has been successfully applied in the automotive, electronics, medical and precision engineering industries

weighs 27g and an effective volume of 3.5cm³, the material removal by machining process that starts with a volume of 15cm³ block would represent a material wastage of 77 per cent.

The SIMTech PIM laboratory set up in 1995 has accumulated extensive research experience in this process and has demonstrated its capabilities of producing a variety of products with various metals and ceramic materials. This was made possible through close collaborations with local PIM companies in new product development and in addressing their technical challenges in this area.



For enquiries, please contact

Dr Chen Wei Long, Director

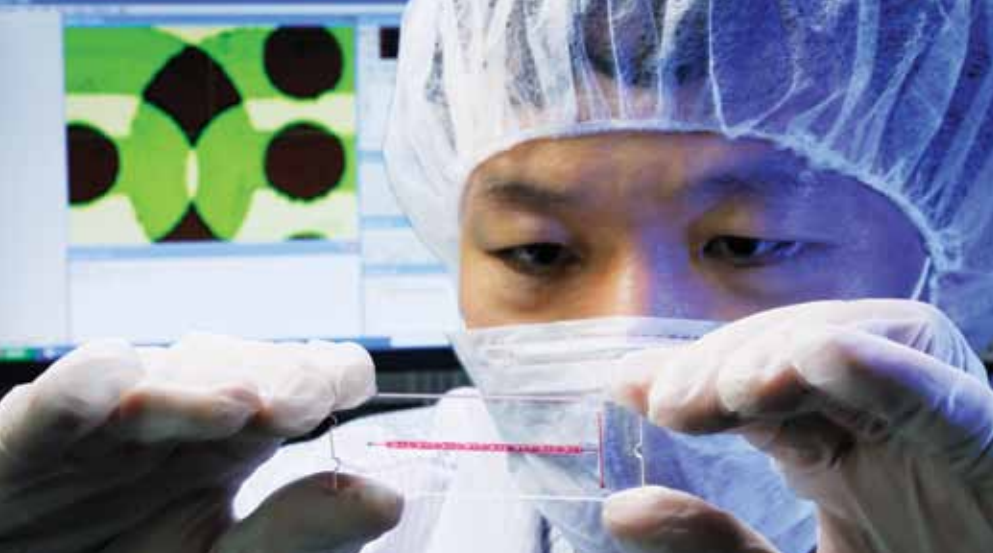
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SMC Sustainable
Manufacturing Centre
Embracing Sustainable Manufacturing



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REDUCING FLOW RESISTANCE AND BUBBLES IN POLYMER-BASED MICROFLUIDIC CHIPS

Overcoming these challenges accelerate the use of these microfluidic devices

Polymer-based microfluidic devices are increasingly popular due to its low cost and easy processing as compared to silicon-based devices. However, most polymeric materials are water repellent in nature, producing high flow resistance and even bubbles in thin channels of microfluidic devices. These lead to high operation pressure and high device complexity.

For some special polymers used in separation membranes, biosensors, and microfluidics, the hydrophobic surfaces generally attract proteins,

The treatment approach can be carried out at room temperature within 10 minutes, which makes this approach easy to scale-up at relatively low cost

resulting in deposition and growth of micro-organisms on surfaces, causing contamination.

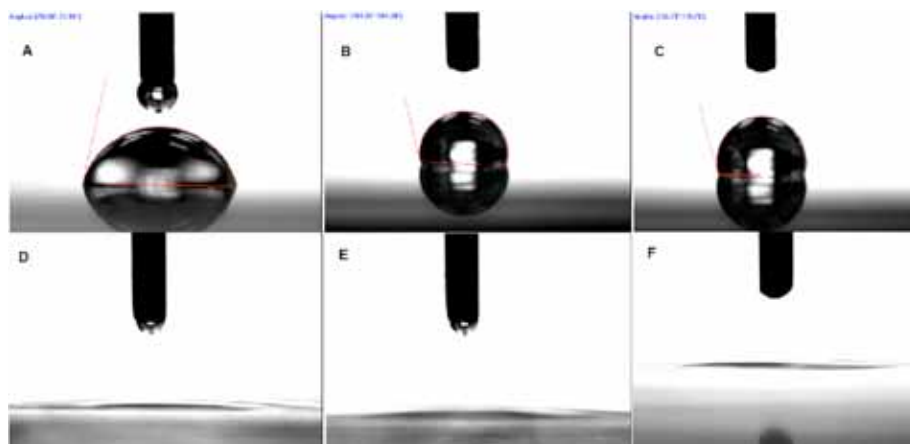


Figure 1: A comparison of the flow resistance and the bubbles between untreated (Figures A, B and C) and coated (Figures D, E and F) types of polymer microfluidic devices

SIMTech developed superhydrophilic (water-absorbing) polymer-based microfluidic chips to reduce flow resistance and bubbles. In this approach, the polymer substrates are first activated by oxygen plasma treatment. A water-based coating is then added on the plasma treated polymer substrate and then ultra-violet curing is applied on the coated surface to enhance chemical bonding of the coating to the polymer substrate.

The treatment method can be applied on various polymer substrates including cyclic olefin copolymer (COC), polycarbonate (PC) and poly methyl methacrylate (PMMA) (Figure 1). A porous coated layer is generated on each of the polymer surface. Chemical bonds are formed between the coated layer and the substrates which generates very high adhesion strength between the coating and the polymer materials. The transparency of the treated substrate is not affected by the coating which is important as many microfluidic applications involve microscopic analyses (Figure 2).

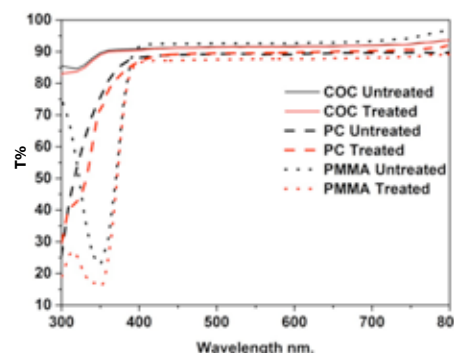


Figure 2: Transparencies of the untreated and coated surfaces of various types of polymer microfluidic devices remain unchanged

Superhydrophilic microfluidic channels with reduced flow resistance and bubbles are used in self-powered microfluidic devices for diagnostic purpose. This technology can also be used on medical devices for anti-contamination application. Arising from the development, a technology disclosure is under preparation.

For enquiries, please contact **Dr Jeffery Chen** at 6793 8259 or email to jfchen@SIMTech.a-star.edu.sg

A number of events were organised in 2015 to engage the industry and forge partnerships



Visit of Deputy Prime Minister & Minister of Finance to Ling Kwang Home, 20 May

The RFID tagging system developed by SIMTech for linen and clothings to minimise the occurrence of lost laundry and facilitate stock checking and counting was demonstrated at the Ling Kwang Home during a visit by Deputy Prime Minister & Minister for Finance, Mr Tharman Shanmugaratnam. The tagging system is expected to be installed in Ling Kwang Home in 2016.

Swiss-Singapore Workshop on Large Area Processing Technology, 19 May

This event jointly organised by SIMTech, the Centre Suisse d'Electronique et Microtechnique (CSEM) and swissnex Singapore attracted 209 participants. Large Area Processing is a key enabling technology for applications such as Printed Electronics. Speakers from Singapore and Switzerland, including prominent industry leaders, provided critical technological insights on the latest updates in the global Printed Electronics industry; applications; materials and processes as well as future opportunities. This workshop showcased an array of Large Area Processing technology, the services, products and competencies of SIMTech's Large Area Processing Foundry for industry.



PE COI Annual Conference 2015, 15 April

The event, attended by more than 240 participants, provided an invaluable opportunity for SMEs in Singapore to explore business partnerships with leading manufacturers in the oil and gas, aerospace, MedTech and complex equipment sectors - particularly with increasing localisation activities in these sectors. Local companies learnt about the trends, gaps and strategies involved and that industry-wide collaborative projects can be cost-effectively formed with the support from A*STAR, SIMTech, SPRING Singapore, EDB, other government agencies and PE COI. Mr Tan Hui Khim, Director, Supplier Development from EDB shared the opportunities for the local PE companies and some of the EDB and other government agencies support for suppliers. The industry leaders presented their localisation requirements and supply chain development programmes. PE COI initiatives were highlighted on the key capabilities available to enable local companies to confidently undertake higher precision and higher value manufacturing activities.

An exhibition tour of the Technologies Hub at MTA 2015 was organised for the participants to witness technology demonstrations by our researchers.



Singapore Manufacturing Federation Visit, 10 April

The Metal Machinery and Engineering (MME) Industrial Group from the Singapore Manufacturing Federation visited SIMTech. Led by the Chairman of the MME Industrial Group, Mr James Wong, potential collaborations were discussed, followed by a tour of the research laboratories.

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

Inventory Management Technology System (IMTS)

20 July 2015 | SIMTech Training Room

The IMTS CIP programme aims to help companies deploy a RFID / Barcode Item Management and Tracking System (IMTS) to better manage, track and audit their assets and inventory to improve productivity, traceability and minimise errors.

For enquiries, please contact **Mr He Wei** at
Tel: 6793 8969 | Email: whe@SIMTech.a-star.edu.sg

Novel Deformation-based Surface Texturing System for Friction Reduction Application

29 July 2015 | SIMTech Training Room

This CIP aims to develop incremental micro-embossing and micro form rolling systems for deformation-based metal surface texturing. Furthermore, laser texturing technique for tool & die and mould industry are introduced.

For enquiries, please contact **Dr Mehrdad Zarinejad**
at: Tel: 6793 8513 |
Email: mehrdad@SIMTech.a-star.edu.sg



eBeacon

31 July 2015 | SIMTech Training Room

This CIP aims to train the participants to use the RFID technology for eBeacon, a positioning system powered by low-cost Bluetooth transmitters that can identify smart phone users of their presence. It enables automatic and instant tracking of employee movements, resources or assets tracking and push promotions and offers to target customers at the right place and time.

For enquiries, please contact **Dr Liu Wei** at
Tel: 6793 8271 | Email: wliu@SIMTech.a-star.edu.sg

Electronic Data Logging for Job Tracking & Report Generation

3 August 2015 | SIMTech Training Room

This CIP aims to train and equip companies with electronic data logging capabilities for job tracking and report generation, through technology and Android apps.

For enquiries, please contact
Mr Chong Wee Keat at Tel: 6793 2403 |
Email: wkchong@SIMTech.a-star.edu.sg

FITPRISE Business Process Automation & Tracking System

3 August 2015 | SIMTech Training Room

This CIP provides companies with a Business Process Automation & Tracking System to help companies better manage their business by automating and tracking their business processes to ensure information is entered once and flows through the various functions, removing duplicate work.

For enquiries, please contact **Mr Foo Yeong Han** at
Tel: 6793 8350 | Email: yhfoo@SIMTech.a-star.edu.sg



Overall Equipment Effectiveness Monitoring System (OEE-MS)

17 August 2015 | SIMTech Training Room

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 shop floor. Shop floor managers through a real-time dashboard have better oversight on all machine production activities, resulting in productivity increases.

For enquiries, please contact **Mr Wong Ming Mao** at
Tel: 6793 8381 | Email: mmwong@SIMTech.a-star.edu.sg

SIMTech Annual Manufacturing Forum 2015 (AMF'15)

23 July 2015 | 9.00am - 5.00pm | Hilton Hotel, Singapore

SIMTech AMF'15 with the theme, Future Automation—more than robotics—highlights the new automation technologies that create impact for future manufacturing. A flagship Conference of SIMTech, AMF'15 is a platform for industry and Institutes of Higher Learning to exchange ideas to address the current challenges in manufacturing to improve the companies' productivity. In its 10th edition, SIMTech AMF'15 comprises the Annual Manufacturing Lecture by technology leaders from industry and parallel tracks in Physical Systems and Cyber Systems.

For enquiries, please contact **Ms Samantha Chan** at samantha@SIMTech.a-star.edu.sg or 6793 8423

SIMTech-WDA PE Workforce Skills Qualifications (WSQ) Graduation Ceremony

13 August 2015 | 6.30pm - 9.00pm | SIMTech Auditorium, Tower Block

The graduation ceremony is dedicated to congratulate the Professionals, Managers, Engineers and Technicians (PMETs) who have successfully completed their training. More than 350 PMETs are receiving their certificates at the ceremony, the fourth since 2012.

For enquiries, please contact **Ms Zhang Yi** at zhangyi@SIMTech.a-star.edu.sg or 6793 8512

MPTC Annual Conference and Technology Exhibition 2015

8 October 2015 | 9.00am - 5.00pm | SIMTech Auditorium, Tower Block

In its fourth edition, this event focuses on SkillsFuture for Manufacturing. The event generates awareness of productivity improvements by local enterprises through the use of manufacturing technology. An industry leader will be sharing successful adoption of a specific technology or initiative by a company representative. Parallel Track Sessions focus on the various areas of innovation: business/automation/operations/process. Complementing the conference is an exhibition to showcase the available technologies, products and expertise to assist local enterprises in their productivity improvement journey. Productivity Discussion Sessions are planned.

For enquiries, please contact **Ms Samantha Chan** at samantha@SIMTech.a-star.edu.sg or 6793 8423



Scan for more events

PE WSQ Graduate Diploma in Advanced Welding Technologies**Module 1: Design Arc Welding**

28 July 2015 | 6.30pm - 9.30pm, SIMTech, Tower Block

PE WSQ Graduate Diploma in Metal Manufacturing Processes**Module 1: Evaluate Advanced Metal Machining Techniques**

4 August 2015 | 6.30pm - 9.30pm, SIMTech, Tower Block

PE WSQ Programme in Carbon Management (Batch 6)

11 August 2015 | 6.30pm - 9.30pm, SIMTech, Tower Block

PE WSQ Graduate Diploma in Manufacturing Operation Management (MOM)**Module 4: Advanced Planning and Scheduling**

19 August 2015 | 6.30pm - 9.30pm, SIMTech, Tower Block

PE WSQ Graduate Diploma in Mechatronics**Module 4: Apply Industrial Robots and Automation**

26 August 2015 | 6.30pm - 9.30pm, SIMTech, Tower Block

PE WSQ Operations Management Innovation (OMNI) Programme (Batch 36)

1 September 2015 | 6.30pm - 9.30pm, SIMTech, Tower Block

PE WSQ Graduate Diploma in Precision Measurement Characterisation**Module 1: Geometric Dimensioning and Tolerancing**

1 September 2015 | 6.30pm - 9.30pm, SIMTech, Tower Block

PE WSQ Apply Electro-chemical Processes and Coatings for Wear and Corrosion Protection

7 September 2015 | 6.30pm - 9.30pm, SIMTech, Tower Block

PE WSQ Graduate Diploma in Advanced Welding Technologies**Module 2: Implement Laser Beam Welding**

15 September 2015 | 6.30pm - 9.30pm, SIMTech, Tower Block

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

For general enquiries, please contact Tel: 6793 8383 | Email: 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.

