

MANUFACTURING MATTERS

April 2018 | Issue 2

A publication of the Singapore Institute of Manufacturing Technology

SIMTech Celebrates 25 Years of R&D for Industry



1993 - 2018
for Industry



FEATURE PE COI: A DECADE OF SUPPORTING THE PE INDUSTRY

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NOTE FROM EDITOR...

Dear Friends and Industry Partners,

We are celebrating our 25th anniversary this year, with "Partnership for Impact" as the theme. To mark this milestone, we have launched the SIMTech 25th anniversary logo, with design inputs from staff who have participated in a logo design contest. The logo graces the cover page of this issue of Manufacturing Matters, and is placed in all of our collaterals this year.

The logo signifies SIMTech's 25-year journey (represented by the 2 in red) in propelling the industry (depicted by the 5 in blue) to achieve success and impact for the economy (denoted by the red star). The circular symbol is a fusion of the 3 Cs - Intellectual Capital, Industrial Capital and Human Capital, an outcome of our partnership with the industry. The logo also incorporates SIMTech buildings at its two locations - at the NTU Valley Block and Fusionopolis 2.

A series of upcoming and celebratory events are in the pipeline:

- PE COI Annual Conference (18 Apr)
- SIMTech Annual Manufacturing Forum (Jul)
- SIMTech 25th Anniversary Gala Dinner (Aug)
- SIMTech-SSG PE WSQ Graduation Ceremony (Aug)
- EAC Annual Conference (Sep)
- MPTC Annual Conference (Oct)
- SMC Annual Conference (Nov)

2018 also commemorates the PE COI's 10th year in assisting companies leverage technologies for innovation to sustain and advance their businesses. Set up in 2007, PE COI is a national initiative launched by SPRING Singapore to help PE SMEs leverage state-of-the-art technology for innovation and growth. Hosted at SIMTech, PE COI has worked with many companies to develop and transfer technologies and provide manpower training as well as consultancy services to meet the manufacturing needs of local PE companies. Read more about PE COI and its collaborative work in this issue's Feature.

Swee Heng

Editor, Manufacturing Matters

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



PE COI: A DECADE OF SUPPORTING THE PE INDUSTRY

PE COI assisted the industry in R&D, capabilities development and technology transfer through Collaborative Industry Projects, One-to-One collaborations and consultancy

This year, PE COI marks a decade of supporting Singapore PE companies and helping them transform.

Launched in 2008, PE COI has initiated **60** Collaborative Industry Projects (CIPs), completed **more than 1,211** industry projects and **645** consultancy projects. It has organised **287** events reaching out to **over 12,900** participants from industry. Details of some of PE COI's assistance in transforming PE companies are highlighted below.

Collaborative Industry Projects

The 3D Additive Manufacturing (AM) CIP was participated by 5 companies including **3D Matters**, a local printing service bureau. Through this CIP, 3D Matters acquired capabilities in Selective Laser Melting (SLM) technology, expanded its capabilities beyond polymer printing to 3D metal printing and established 3D Metalforge which provides 3D metal printing services.

“ **3D Metalforge is a good example of how a local SME has benefitted from innovation and collaboration** ”

Mr S Iswaran, Minister for Trade and Industry (Industry), at the launch of 3D Metalforge's 3D Metal Additive Manufacturing Centre on 17 May 2017

Another example is the CIP with **SIA Engineering Company** and 4 local SMEs to manufacture polymeric aircraft cabin components. PE COI transferred the knowledge in design, simulation, manufacturing of polymeric materials and its technologies on fabrication of special aircraft cabin parts to the SMEs.

“ **As a result, these SMEs have diversified beyond their traditional precision engineering capabilities to design and manufacture aerospace components. And they too have consequently raised their revenues by up to 25%** ”

Mr S Iswaran, during the Committee of Supply Debate on 6 March 2015



and Optics technologies for its business growth. PE COI and WOE then developed a first-of-its-kind miniaturised laser calorimeter-based instrument to characterise the absorption of optical components used in high power laser applications. WOE licensed the developed technology for in-house production and product commercialisation. WOE has also worked with PE COI to develop a Portable Infrared Spectrometer that is more cost effective than the existing ones in the market. These collaborations have enabled WOE to grow its business from an equipment manufacturer to an equipment developer.

Industry Partnership

PE COI worked with these companies individually to build their capabilities:

Component Technology Pte Ltd (CTech), a local SME which distributed wire/die bonder and X-ray inspection systems for the semiconductor industry, jointly conducted a feasibility study with PE COI in 2006 on using optical methods to inspect 3D wire loop under the environment of specular, metallic surface reflection, which was an unsolved issue for the last 15 years.

Based on the feasibility study result, CTech set up a new company and recruited 20 Research Engineers to work with SIMTech in 2007 to develop the world's first 3D optical wire bond inspection system. The system has been integrated into its customers' production lines. SIMTech has assisted CTech's transformation from an equipment distributor to an original equipment manufacturer.

Fong's Engineering & Manufacturing Pte Ltd engaged a PE COI consultant to assist in the design and development of a medical instrument to expand into manufacturing of medtech devices.

The consultant helped Fong's Engineering expedite the preparation process for product manufacturing.



PE COI also trained six of the company's engineers in original design manufacturing facilitating Fong's Engineering's transformation from being a build-to-print manufacturer to an original design manufacturer.

Yan San Metals Pte Ltd, a local SME, collaborates with PE COI to develop a mobile Friction Stir Welding (FSW) process for on-site welding of large aluminium panels that are used in the construction, transport, marine and oil & gas industries. PE COI provided system structural and interface design, stress analysis and process development optimisation and validation. The innovative dual-beam overhang design allows welding of large aluminium panels of up to 10 metres long with unlimited width. This system improved productivity by 200 per cent for welding of large panels as it reduces logistic costs and time, creating enhanced flexibility on design and work flow.

“ Due to this technology, Yan San and its customers from the various industry sectors attracted more engineers and technicians into high value jobs which could enhance industries tremendously ”

Mr Quah Poh Keng, Managing Director, Yan San Metals Pte Ltd

Wavelength Opto-Electronic (S) Pte Ltd, a local manufacturer of infrared optics components, first engaged SIMTech since 2007 in an Operations and Technology Roadmapping (OTR) programme which identified Lasers

“ In collaborating with SIMTech, we have access to a pool of excellent scientists who have great innovative ideas and methodology. This has greatly influenced our own engineers to create jointly a product to resolve our pending issues and challenges ”

Mr Robert Huang, CEO, Wavelength Opto-Electronic (S) Pte Ltd

Moving Forward

PE COI will work closely with companies, trade associations and government agencies to assist SMEs to take on higher value-added activities and build up new technical capabilities of local companies as part of fostering innovation as well as supporting development of new technologies.

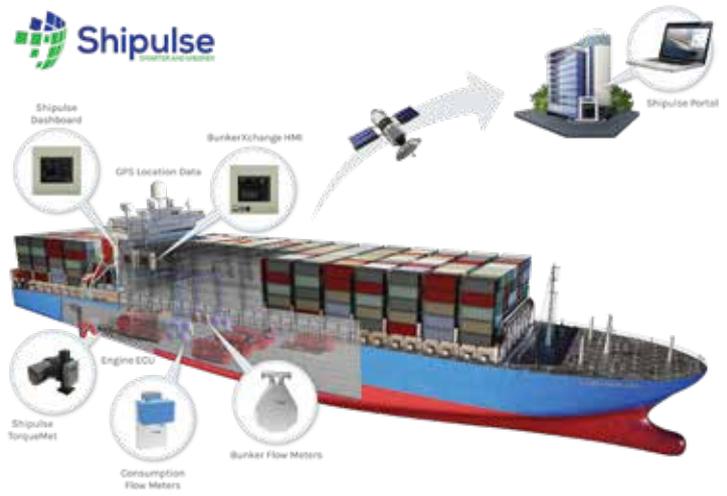
**Note: CIP is a platform for companies with common interest to conduct R&D and develop competitive technologies*

For enquiries, please contact
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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



GAME CHANGING SYSTEM FROM T-UP

A portable system that separates circulating tumour cells from blood has been developed by SIMTech researcher during his T-Up at Racer Technology Pte Ltd, one of the leading medical healthcare contract manufacturers in the world. This developed system can detect wholly intact and viable circulating tumour cells from small amounts of blood in a relatively short time.

To arrive at this, the researcher carried out a market study and intelligence gathering of requirements and demands in Asia. A prototype was developed involving the design, making and testing according to requirements, quality assurance and potential improvements. This led to the design, production and testing of processes to ensure quality and potential optimisations during mass production.

This portable system gives Racer Technology an edge over commercially available equivalents. It contributes significantly to relatively early cancer detection as the system shortens diagnostics lead-time by 80 per cent, from an hour to a little over 10 minutes. It is also one of the first systems that can automate retrieval of cancer cells from using just 1ml and 5ml of blood.

The T-Up helps Racer Technology expand its existing business into the tumor detection market, improving its business revenue in future. The company also hired additional engineering R&D headcount to support further development.

“ Engaging SIMTech to capitalise its expertise to steer us on an amazing journey was an incredible and a positive experience! ”

Mr Willy Koh, CEO, Racer Technology

*Note: The T-Up initiative, a multi-agency effort by A*STAR, the Economic Development Board, SPRING Singapore, IE Singapore and the Infocomm Development Authority, involves seconding RSEs to local enterprises to access the pool of R&D talent in Research Institutes.*

For more information, please contact **Mr Cedric Yon** at xyyon@SIMTech.a-star.edu.sg

OPERATIONS & TECHNOLOGY ROADMAPPING (OTR) JOURNEY GROWS SME

Ascenz Solutions Pte Ltd, a solutions provider for shipping vessels within the maritime industry, participated in SIMTech's Operations and Technology Roadmapping (OTR) programme in 2010 to develop its long-term technology development strategy.

After going through 5 half-days of vigorous ideation and consensus-building, Ascenz was prepared to tackle the market with various new initiatives. One of these is the continuous upgrading and improvement of Shipulse, its vessel performance tracking and optimisation software, with various features (bunker profiling, remote diagnostics, automated data mining processes), that have been added over the years. Ascenz was also certified under ISO/IEC 27001 for Information Security Management (2017) and ISO9001 for Quality Management Systems (2015). It embarked on an aggressive internationalisation strategy with offices and agency representation in more than ten countries, including Nigeria and Thailand, to tap on emerging markets.

“ OTR is an important exercise for every company as it helps the company to have a clear direction ”

Mr Chia Yoong Hui, Chief Executive Officer, Ascenz Solutions Pte Ltd

From these initiatives, Ascenz expanded from a two-man outfit in 2010 to a healthy team of 36 individuals by 2017. A technical team, including 7 personnel in Product Development, was set-up alongside a 10-man business development unit. Ascenz' revenue also increased year-on-year from 2010 to 2017. The company was awarded the Enterprise 50 Award twice in 2016 and 2017, and won the Entrepreneur of the Year for Maritime Technology Solutions in 2017. Due to the strength of Ascenz' brand, the company attracted Bureau Veritas SA, a global leader in Testing, Inspection and Certification, to sign an agreement for it to provide ship performance and monitoring solutions to shipowners globally. In addition, GTT, a leading company in LNG containment systems for shipping and storage, recently acquired 75 per cent of the share capital of Ascenz, catapulting it to the forefront of the global LNG market.

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



OVERALL EQUIPMENT EFFECTIVENESS SYSTEM LANDS SME WITH HIGHER VALUE WORK

System implemented as an integral part of its digital manufacturing goal

JEP Precision Engineering (JEP) a home-grown company has successfully transformed and digitalised its manufacturing operations. The company does large format precision machining of specialised materials such as Inconel and titanium, and mainly services the aerospace industry with products ranging from combustor engine casing for commercial aircraft, to air management systems and landing gear components.

JEP has taken a systematic and holistic approach to improve its overall productivity and reduce its reliance on low skilled manpower at its new Smart Factory at Seletar Aerospace Park. Housing a production space that is 2 times bigger than its previous premises, JEP invested into large scale deployment of digital manufacturing solutions in robotics, automation and smart factory software in the new facility.

Playing a role in JEP's Smart Factory set-up is the implementation of Overall Equipment Effectiveness Monitoring System (OEEMS) by SIMTech. Previously, JEP used a paper-based method to keep track of the machine operation details, such as machine set-up and downtime. However, this manual method is time-consuming and prone to human error.

“Digital systems deployed have helped JEP secure higher value contracts with major aerospace Original Equipment Manufacturers (OEMs) for the production of flight-critical aircraft parts and achieved close to 12 per cent increase in revenue in 2017”

Mr Soh Chee Siong, CEO,
JEP Precision Engineering

Hence, it is not ideal to analyse the manually collected data to improve productivity.

To address this, JEP implemented the OEEMS on all 90 machines to provide real-time machine visibility. The OEEMS provides live machine status updates through the dashboard, and automatically captures data on machine stoppages, such as the cause and duration for each stoppage.

Through this system, JEP can easily monitor its operations on the shopfloor, as well as identify top reasons for stoppages to develop effective measures that can reduce



machine downtime and maximise machine utilisation. By monitoring and analysing the performance of all of JEP's 90 machines, the OEEMS improves company machine utilisation by close to 30 per cent and achieves 15 per cent increase in yield.

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MPTC Manufacturing Productivity
Technology Centre
Enhancing Manufacturing Productivity



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IN-PROCESS WATER USAGE OPTIMISATION

A general approach is in place to recycle waste water

Singapore's water use is expected to more than double by 2060 from about the current 430 million gallons a day now. While the Public Utilities Board (PUB) is looking at expanding water supply capacities, used water management to reduce resource drainage is a measure to counter the challenges of urbanisation and climate change. Water saving through reducing usage and recycling used waters ranging from domestic to industry activities can impact directly on strategic resource saving.

Towards this, SIMTech has been working with local companies on in-process water usage optimisation. A general approach is to:

- Map water usage and analyse water quality at different process steps
- Select treatment methods or solution development of new water technologies
- Design conceptually treatment system and estimate its cost
- Work with local engineering partners on system fabrication, installation and commissioning

Work in Progress has already started with companies and examples include SIMTech:

- Partnering with a local SME and a MNC to install an in-line system



at a local semi-conductor company to recycle the rejected water from its Reverse Osmosis (RO) facility. 60 to 70 per cent of the RO rejected water will be recycled to replace part of the NEWater supply

- Working with an Engineering Partner to implement a pilot treatment system in a local SME Bean Curd making factory to recycle in-process waste water for non-food application such as floor flushing or toilet usage

- Developed simple and cost effective process and, working with an engineering partner to design and fabricate an easy operating treatment system for Fluoride (F) removal from industrial waste water to meet PUB's Trade Effluent Discharge Limit (F content < 15 mg/L).

A local semi-conductor fixture and jig cleaning company will be adopting Fluoride removal from industrial waste

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SMC Sustainable Manufacturing Centre
 Embracing Sustainable Manufacturing



Scan for more information on Sustainable Manufacturing Centre



GROWING SMART WEARABLES WITH FLEXIBLE HYBRID ELECTRONICS

SIMTech Collaborative Industry Project initiated for industry to harness business opportunities

The market for smart wearable electronics is expected to grow to US\$52 billion by 2022, up from US\$16 billion in 2015 at a Compound Annual growth Rate of 16 per cent (MarketsandMarkets, 2017). Flexible Hybrid Electronics (FHE), key enabling technology for wearable electronics is integrating ultra-thin silicon, components using precision engineering handling; printing with conductive and active inks and pasting on stretchable substrates. The applications of smart wearables are in sports and fitness, healthcare and wellness monitoring as well as infotainment. To tap this huge potential, flexible wearable energy source; low power chips; smart textiles embedded with bio-sensors and stretchable/FHE are urgently required key technologies.

To equip the local industry and grow the eco-system to be ready for the explosive growth in smart wearables, SIMTech launched the Collaborative Industry Project (CIP) on Smart Wearable Innovation Programme which is aligned to the national goal of positioning Singapore for the future via innovation. Through this CIP, SIMTech develops capabilities in design, prototyping and manufacturing of printed heater, printed sensor and printed electronic products for Smart Wearable Product Development. Groundwork was initiated last November with Textile and Fashion Federation (TAFF) of Singapore through seminar and roundtable discussion to educate the industry on Wearable Technology.

The CIP comprises three phases. In the Learning phase, 14 workshops are provided to train participating companies in 10 key printed electronics and wearable technologies as well as their applications to create smart product innovation. On completion, the Innovate/Prototyping Product Development phase engages the companies to generate ideas and product design. Over the next 5 months, SIMTech will work with individual participating companies to develop their smart wearable products. Cost analyses, characterisation and reliability of the smart wearable products developed by individual companies are also carried out. In the third phase (Commercialisation), member companies will participate in exhibitions and overseas tradeshows to promote CIP members' capabilities to find new business opportunities in

“ This CIP programme provides us with exactly what we need. We strongly believe that smart wearable apparel is the future. Through our engagements with SIMTech and TAFF, we learnt how to leverage our core expertise in textiles and introduce game changing technologies into our apparel ”

Mr Justin Tan, Product Manager, Tex Line Associates Pte Ltd

“ Lee Yin is excited by the future-state that SIMTech had shared in smart wearables. The advent of smart wearables will revolutionise apparel and textile, and we want to be at this leading edge of innovation. This CIP is an excellent platform for us to learn from the experts, and to help us prepare and create the right products ”

Mr Clarence Lee, COO, Lee Yin Group

smart wearables. The CIP programme also enables various partnerships to be formed to create a vibrant eco-system for smart wearables in Singapore.

“ KaHa is delighted to work alongside SIMTech as a strategic partner, to guide and develop the nascent but exciting Smart Wearables and Flexible Hybrid Electronics eco-system in Singapore. CIP is a great platform to engage with partners to testbed ideas and launch new innovative products ”

Ms Sim Seo Lay, Head of Business Development & Operations, KaHa Pte Ltd

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EAC Emerging Applications Centre
Seeding and Growing Emerging Industries



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BRIDGING FROM GRADUATE DIPLOMAS TO MASTER DEGREE

Skills upgrading pathways to meet industry needs

Starting 2016, all graduates from SIMTech Workforce Skills Qualifications (WSQ) Graduate Diplomas are accepted for entry into the Master of Science in Engineering Business Management (MEBM) by The University of Warwick's Warwick Manufacturing Group (WMG), offered in collaboration with SIMTech and Singapore Institute of Management Global Education (SIM GE).

WMG has a strong reputation in the UK for its ability to help companies develop a competitive edge by addressing

relevant skills needs. SIMTech, a research institute of A*STAR with state-of-the-art research facilities, has strong links to manufacturing companies in Singapore.

Under the collaboration, Warwick delivers all modules in Singapore, SIM GE provides academic support while SIMTech offers laboratory facilities and support for MEBM dissertation.

The collaboration creates a bridge between SIMTech's WSQ Graduate Diplomas to a Master Degree which

signifies the increased acceptance of the SIMTech WSQ Graduate Diplomas programme as an alternative skills upgrading pathway for Professionals, Managers, Executives and Technicians (PMETs).

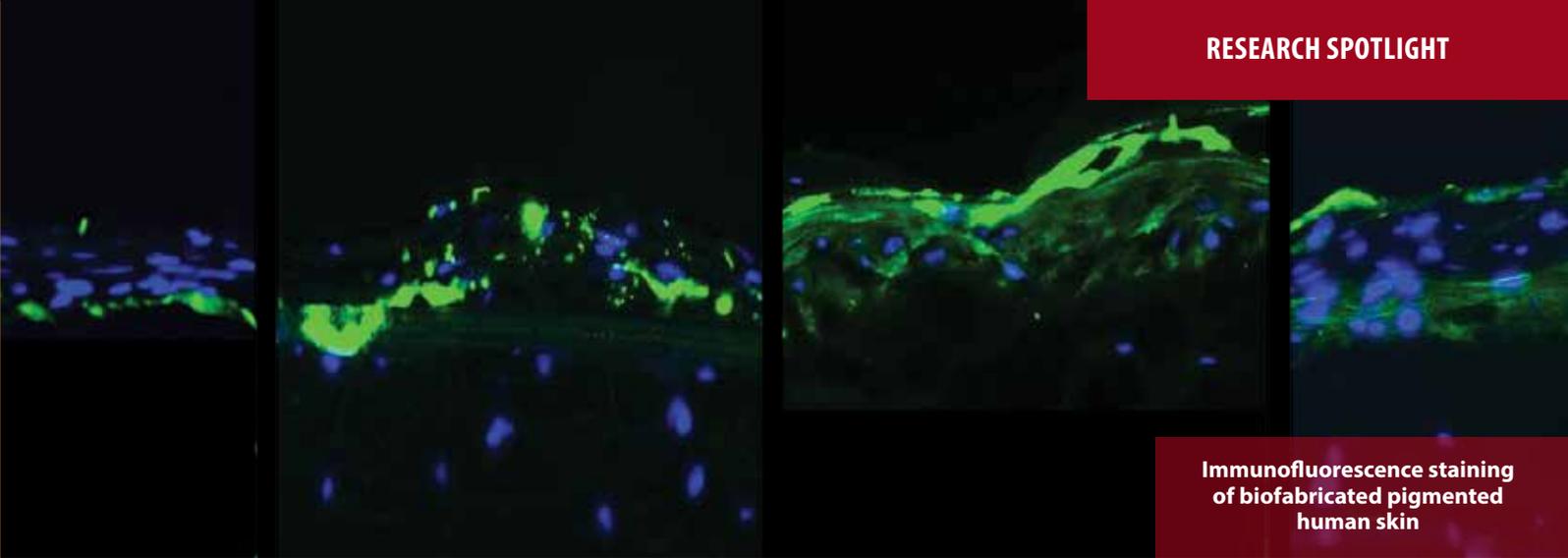
More than 200 participants have graduated from this programme.

Local PMETs can enrol for the MEBM on a part-time basis for two years or full-time basis for one year. For more details on the MEBM, visit www.simge.edu.sg

“ **MEBM degree helps open the mind for innovation and creation. The training made me realise that there are thousand and one ways to solve issues. The industrial Speakers, Warwick Lecturers and SIMTech Supervisors who shared their industrial and research experience have an influence on this** ”

Ms Kuan Bee Lan, Recipient of Warwick WMG Departmental Prize 2010, General Manager, Delimax Pte Ltd

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Immunofluorescence staining of biofabricated pigmented human skin

A BREAKTHROUGH IN CUSTOMISED SKIN FABRICATION

Novel process can achieve uniform pigmentation in lab-grown skin

With the recent ban of animal testing on consumer products, tissue-engineered (TE) skin grafts for skin repair and grafting are finding new applications in toxicology and chemical testing. A typical TE skin comprises keratinocytes grown over a 3D collagen-fibroblast matrix. However, this simplified 3D tissue construct lacks complex features, one of which is the presence of skin pigmentation.

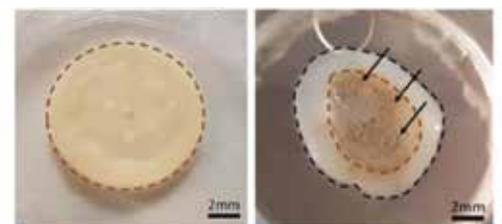
A collaboration between SIMTech's Bio-Manufacturing Programme (BMP) and Singapore 3D Printing Centre (SC3DP) of Nanyang Technological University (NTU) demonstrates a proof-of-concept process for fabrication of 3D pigmented human skin constructs using three different types of skin cells. The process consists of a multi-step strategy, starting with formulation of a suitable co-culture medium to support and maintain the growth of all three

types of skin cells. A collagen-based composite bioink is first formulated, using macromolecular crowding, a phenomenon that manifests the attraction of macromolecules to each other at high concentrations, to regulate mechanical properties. Subsequently, a 3D bioprinter is used to deposit cell droplets that emulate the epidermal melanin units (pre-defined patterning of keratinocytes and melanocytes at the desired positions) along with the bioink to achieve biomimetic 3D structures. This ability enables one to control the spatial arrangement of the keratinocytes and melanocytes in a highly-specific manner and to fabricate biomimetic 3D structures that facilitate critical cell-cell and cell-matrix interactions. Hence, a multi-layered construct is designed to mimic the human skin such that it can support functional proliferation and differentiation of the different cell types required to achieve pigmentation. The

3D printed constructs are then cultured over time under specific conditions to eventually achieve 3D human skin constructs with uniform skin pigmentation.

Microscopic analysis indicates the presence of a well-developed skin surface region and uniform distribution of melanin granules in the top layer of the 3D bioprinted pigmented skin constructs which lead to the presence of uniform skin pigmentation.

3D Bioprinting Approach Manual Casting Approach



Representative images of 3D pigmented human skin constructs (Ref: Ng, Wei Long, et al. "Proof-of-concept: 3D bioprinting of pigmented human skin constructs." *Biofabrication* 10.2 (2018): 025005)

**Note: This research is part of a PhD dissertation by Ng Wei Long, a local AGA scholar with NTU. He was awarded a PhD in December 2017*

For more information, please contact **Dr May Win Naing**, Bio-Manufacturing Programme at winnaingm@SIMTech.a-star.edu.sg

This innovative process can potentially be automated to fabricate skin constructs at scale for applications in the clinic, toxicology testing and fundamental cell biology research

A number of events were organised in 2018 to engage the industry and forge partnerships

SIMTech Partnership Night 2018 and Launch of SIMTech 25th Anniversary Celebration, 27 February



More than 190 key and potential industry partners, representatives from trade associations and government agencies networked and witnessed the launch of SIMTech's 25th anniversary logo to mark the start of the institute's silver jubilee celebration. Reinforcing the commitment for closer collaboration, partners from the Singapore Precision Engineering and Technology Association (SPETA), Singapore Manufacturing Federation (SMF), Singapore Chinese Chamber of Commerce and Industry (SCCCI), Semiconductor Equipment and Materials International (SEMI), Print and Media Association Singapore (PMAS), Association of Aerospace Industries Singapore (AAIS), Singapore Transport Association (STA), Workforce Advancement Federation (WAF) and NTUC Learning Hub attended the event. Representatives from A*STAR, Economic Development Board, Jurong Town Corporation, Skillsfuture Singapore, SPRING Singapore, IE Singapore and Workforce Singapore also turned up in full force to network. SIMTech Partnership Night is an opportunity to update the guests on the institute's activities.

Launch of Collaborative Industry Project (CIP) on Smart Wearable Innovation Programme, 28 February

In collaboration with Textile and Fashion Federation (TAFF) of Singapore and SEMI Singapore, this CIP was launched (see page 7 for details). Ten companies from the electronics, Electronic Manufacturing System, consumer lifestyle, garment, apparel, textile and fashion industry participated in the first batch. The second batch will start in May 2018.



Collaborative Industry Projects (CIPs) are platforms for companies with common interest to conduct R&D and develop competitive technologies



e-Beacon Tracker & Mobile Marketing (Bluetooth)

Bluetooth e-beacons are used to enable location-based targeted tracking or marketing to improve sales and customer service or productivity.

For enquiries, please contact **Mr Chai Lai Sing** at lschai@SIMTech.a-star.edu.sg

Collection Delivery Management System (CDMS)

A mobile Near Field Communication / barcode-based solution to ensure right items are collected and delivered to the right customer on-time.

For enquiries, please contact **Mr Chai Lai Sing** at lschai@SIMTech.a-star.edu.sg

Overall Equipment Effectiveness Monitoring System (OEEMS)

An integrated software which provides real-time machine status, overall equipment effectiveness (OEE) and faster response to deteriorating machine condition to provide visibility and early warning.

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

Maintenance Management System (MMS)

A system to help companies to digitise and manage their activities from preventive maintenance, ad-hoc repairs, spares checking to report generation.

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

Inventory Planning

Inventory policy development in order to control rightsizing inventory and maximise performance, helping companies to save resources.

For enquiries, please contact **Mr Chai Lai Sing** at lschai@SIMTech.a-star.edu.sg

Manpower Scheduling

Manpower scheduling helps planners in shift scheduling and manpower allocation to minimise labour cost.

For enquiries, please contact **Mr Seow Yit Yuee** at yyseow@SIMTech.a-star.edu.sg



3D Additive Manufacturing (AM) Capabilities of Metal and Polymer Parts

This programme aims to demonstrate 3D AM process capability from design and process optimisation, material preparation and handling, product processing to secondary operations, and to provide a platform for quicker adoption of 3D AM technology.

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

3D Marking and Surface Engraving for Medical Devices

This programme aims to demonstrate 3D laser marking and surface feature engraving on complex surfaces with various base materials for medical devices.

For enquiries, please contact **Mr John Lim** at kylim@SIMTech.a-star.edu.sg

Scalable Mobility Platform (SMP) for Mobile Robots

This programme aims to promote the adoption of mobile robot for automating the material transfer through a platform technology. Such platform technology features modular powered castor wheels that enable the development of customised mobile platform to cater for different needs. It allows System Integrators as well as SMEs to understand such technology and to prepare them for developing the mobile robots with desired specification requirements.

For enquiries, please contact **Mr Tan Chee Tat** at cttan@SIMTech.a-star.edu.sg

CIP on Smart Wearable Innovation Programme

This programme aims to equip the local industry and grow the eco-system to be ready for the explosive growth in smart wearables.

For enquiries, please contact **Mr Lim Kim Guan** at limkg@SIMTech.a-star.edu.sg

PE COI Annual Conference 2018

18 April 2018 | 8.30am - 4.30pm | Conrad Centennial Singapore, Grand Ballroom, Level 2

Focusing on Precision Engineering-Transformation, this event enables PE companies understand how they can transform through PE Industry Transformation Map (ITM), leading Singapore into the future of manufacturing. A keynote speaker from Singapore Economic Development Board (EDB) updates on the PE ITM. The conference is divided into four sessions, each align to a PE ITM pillar - Innovation, Productivity, Jobs and Skills, and Internationalisation. Participants can also learn more about other companies and their business transformation journeys at this event.

For enquiries, please contact **Mr Tan Chee Tat** at cttan@SIMTech.a-star.edu.sg

For registration, please visit <https://bit.ly/2uKwVRV>



Scan for more events

PE WSQ Graduate Diploma in Advanced Welding Technologies

Module 1: Design Arc Welding

17 April 2018 | 6.30pm - 9.30pm, SIMTech, Fusionopolis 2

PE WSQ Manufacturing Operation Management (MOM)

Module 2: Operations Analysis

23 April 2018 | 6.30pm - 9.30pm, SIMTech, Fusionopolis 2

PE WSQ Graduate Diploma in Mechatronics

Module 3: Design and Analysis for Machine Vibration

2 May 2018 | 6.30pm - 9.30pm, SIMTech, Fusionopolis 2

Master Class in Emerging Manufacturing Technologies: Design of Biomedical Devices

2 - 4 May 2018 | 8.30am - 5.30pm, SIMTech, NTU Valley Block

Master Class in Strategic Planning for Operational Excellence: Mastering Sales and Operations Planning (S&OP) Process to Align Strategies for Operational Excellence

8 - 9 May 2018 | 8.30am - 5.30pm, SIMTech, Fusionopolis 2

Master Class in Predictive Manufacturing & Services: Supply Chain Analytics - Descriptive, Predictive & Prescriptive Analytics

18 - 19 June 2018 | 8.30am - 5.30pm, SIMTech, Fusionopolis 2

PE WSQ Apply Integrated Carbon Footprint Assessment Methodology (i-CARE)

23 July 2018 | 9am - 6pm, SIMTech, Fusionopolis 2

For course details and registration, please visit <http://kto.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.

