SC3DP
Singapore Centre for 3D Printing

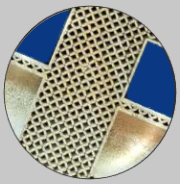
MAY – AUGUST 2025

NEWSLETTER

CHANGING THE WORLD THROUGH ADDITIVE MANUFACTURING

SC3DP Open House 2025

7 November 2025 | 9.30am – 3.00pm
The Arc, Nanyang Technological University,
63 Nanyang Drive, Singapore 636922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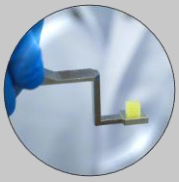

Materials


Process Digitalisation


Sustainability

AI Automation

Professor Paulo Bartolo
Executive Director

MESSAGE

This issue of the Singapore Centre for 3D Printing newsletter aims to provide an overview of the diverse activities conducted by our researchers between May and August 2025. It also reflects the quality of the research work (e.g. publications, new research projects, international partnerships), dissemination activities, and strong links with society, aspects that characterise us. These domains continue to mark our daily activities and consolidate our position as a global hub and leader in additive manufacturing.

The strong funding we continue to attract, both from government agencies and industry, the number of publications in highly prestigious scientific journals, and our laboratories that continue to be equipped with state-of-the-art equipment, mark our present while opening doors to new achievements in the future.

This newsletter arrives on the eve of important initiatives that we are launching for our Open House, that will take place on 7 November and to which I warmly invite you to participate. I would like to highlight the 3D Printing competition “Together We Print: SG60 Unity Challenge”, uniting the nation to co-create meaningful 3D-printed projects reflecting the SG60 spirit.

HIGHLIGHTS

Singapore - Portugal Research Week

Explore Collaborative Opportunities in Additive Manufacturing Landscape

3D Printing for Extreme Manufacturing

A Webinar That Highlight The Potential of Multi-Material Additive Manufacturing (MM-AM)

Makino AML 500

Powering the Future of Metal 3D Printing with Speed and Precision

Industrial Transformation ASIA-PACIFIC (ITAP) 2025

Next-Gen Tech in Manufacturing: The Power of AI, Quantum Computing, 3D Printing & Mixed Reality

NEWS

SC3DP 3D Printing Competition

Join us and participate in the SC3DP 3D Printing Competition and showcase your creativity and innovation through intergenerational collaboration. This year's design themes, "Singapore: Past, Present & Future" and "Singapore as a Green and Sustainable Nation", invite you to reimagine our nation's journey and sustainability goals. Check out the link below for more information.

Submission Date: 21-22 October 2025 | Result Date: 7 November 2025
Link: https://event.ntu.edu.sg/sc3dp-competition-2025

Lakshmi Mohanbabu's Celestial Art Installation

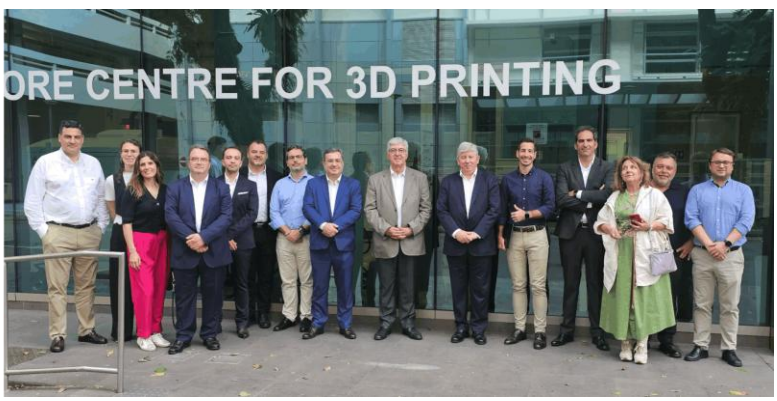
On 27 May, artist Lakshmi Mohanbabu delivered a seminar showcasing her 3D printed Ocean Cubes, part of the world's deepest art installation located 7 Km beneath the ocean's surface near the Mariana Trench, in the coast of Japan. During this seminar, Ms Lakshmi presented her collaborative journey with SC3DP, which started few years ago with her 3D printed interaction cubes sent to the international space station, planning for a permanent Moon Installation in late 2025. Ms Lakshmi Mohanbabu's work bridges extraordinary frontiers by integrating art, technology, and cultural symbolism.

Singapore – Portugal Research Week

From 10 to 12 June, the Singapore - Portugal Research Week brought together leading academics, researchers, and industry representatives from Portugal, as part of our strategy to reinforce research links and industries collaborations with Portuguese organisations. The three-day programme included industrial visits to Fu Yu Corporation, Makino Asia, Meiban, Panasonic, and ST Engineering Aerospace, showcasing innovation and excellence in precision engineering.

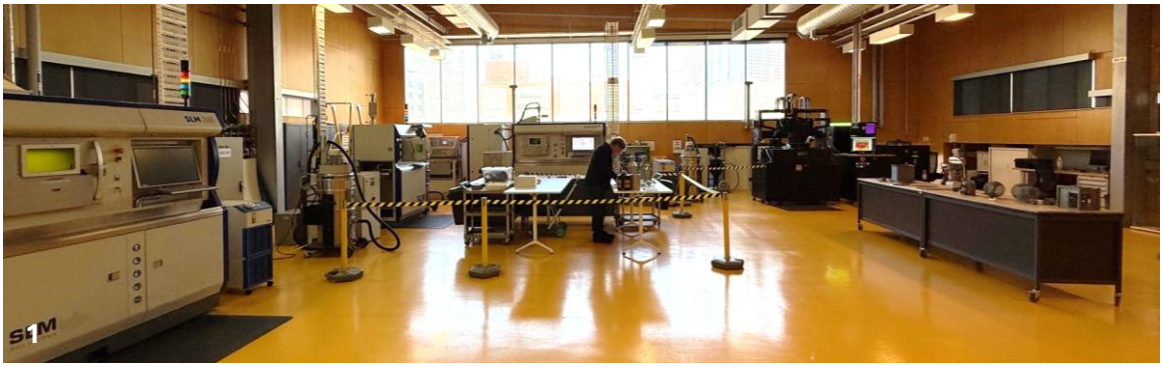
SC3DP and CENTIMFE (Technological Centre for Mouldmaking, Special Tooling and Plastic Industries) spent three days reviewing joint progress and charting new pathways for collaboration. As part of the forum, SC3DP organised a seminar highlighting key developments in additive manufacturing and partnership possibilities. The event was graced by His Excellency Dr Carlos Pires, Ambassador of Portugal to Singapore, who delivered the opening address. Ms Wanda Preiser from NTU's Office of International Engagement provided an overview of the university's teaching and research activities, while the Portuguese Innovation Additive Manufacturing Network, CENTIMFE, Cetim-Matcor, Panasonic, Makino Additive Manufacturing, Leistritz Group and EDP presented their industrial capabilities and research initiatives.

An important moment was the signing of the **Memorandum of Understanding (MOU)** between Nanyang Technological University and the University of Porto, reaffirming a shared commitment to strengthening academic collaborations between the two organisations.



Mission to Australia

In July, a group of SC3DP's representatives, Professor Paulo Bartolo, Associate Professor Daniel New, Associate Professor Tuan Tran, and Research Fellow Cian Vyas visited four leading Australian Universities: RMIT University, The University of Melbourne, Deakin University, and Monash University, with the main purpose to explore opportunities for collaborations. The discussions with the respective AM centres were very productive, with all centres expressing strong interest in establishing partnerships with SC3DP. Highlights from the trip include:



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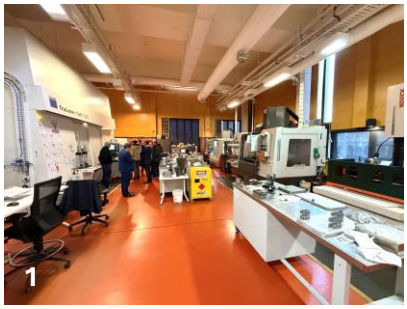
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- RMIT's Advanced Manufacturing Precinct[1] showcased their strength in material development, which is complementary to research activities in SC3DP. This could open possibilities for join projects that combine RMIT's strength with SC3DP's industrial applications.
- Deakin Digital Design and Engineering Centre[2] at Deakin University demonstrated their industry-focused research and expressed a strong interest for student exchange initiatives, with possible support at the University level. At Deakin, the team also visited the Institute for Frontier Materials (IFM) that expressed interest in collaborating with SC3DP to exploit our expertise and facilities to support their world-leading fibre research platforms on advanced and sustainable fibres, metal alloys, batteries, and carbon fibre. A PhD exchange programme was suggested, as well as funding opportunities to facilitate this research work, and relevant joint projects will be identified. IFM will support the use of their in-situ X-ray analysis with near synchrotron-like capabilities for material characterisation.
- Monash Centre for Additive Manufacturing emphasised potential collaborative opportunities and pathway to exchange programmes.
- The University of Melbourne showed interest in collaboration in the fields of advanced materials and building & construction.

In summary, the mission established a strong connection between SC3DP and leading AM centres in Australia, strengthening SC3DP's global network in additive manufacturing.

Professor Paulo Bartolo Appointed Counsellor of the Portuguese Diaspora Council

CONSELHO DA DIÁSPORA PORTUGUESA
World Portuguese Network

In July, Professor Paulo Bartolo was appointed Counsellor of the Portuguese Diaspora Council. Established in 2012 under the High Patronage of the President of the Portuguese Republic, the Council is a non-profit institution dedicated to reinforcing the strategic relationship between Portugal and its global diaspora.

By functioning as both a consultive organisation of the President of the Portuguese Republic and a channel of co-operation, the Council contributes to Portuguese policy priorities through initiatives that attract foreign investment, promote culture diplomacy, and facilitate the exchange of scientific and academic knowledge. Its annual meetings and thematic forums provide the Portuguese Government and Portuguese Institutions with strategic insights on global trends, ensuring that the experience and leadership of the diaspora are effectively integrated into Portugal's long-term development and competitiveness agenda.

Best Paper Award Conferred to PhD Student Jungyeon Kim at the International Conference on Precision Engineering and Sustainable Manufacturing

Jungyeon Kim, MAE's PhD student at SC3DP under the mentorship of Associate Professor Seung Ki Moon, won the Best Paper Award at the International Conference on Precision Engineering and Sustainable Manufacturing (PRESM 2025) in Chiang Mai, Thailand on 6 to 11 July 2025. The award recognises outstanding research quality and impact presented at the conference.

Jungyeon's paper, "AI-based Mechanical Properties Prediction of Sintering-Aging Combined Effect in Metal Material Extrusion," applied Machine Learning (ML) to forecast mechanical performance under combined sintering and aging conditions. The study highlights a practical framework to accelerate materials development by guiding parameter selection and reducing experimental cost in metal material extrusion.

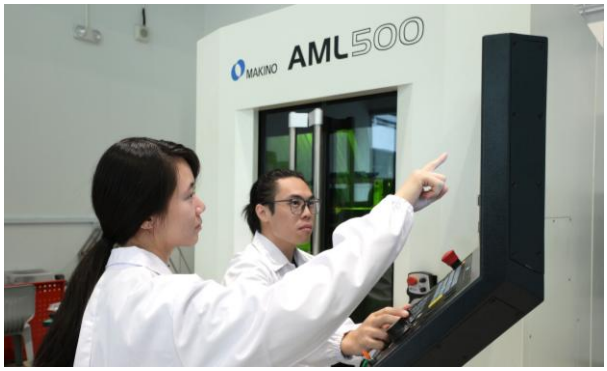
Conference: PRESM 2025 - https://www.presm.org/
Paper title: AI-based Mechanical Properties Prediction of Sintering-Aging Combined Effect in Metal Material Extrusion

Turkey and Greece Research Activities

Between 28 April to 7 May, SC3DP showcased some of its research activities on the global stage at the AMC Additive Manufacturing Conference in Türkiye. Our team formed by research fellows Dr. Mehmet Cagirici and Dr. Evangelos Daskalakis, together with research associate Alpravinosh Alagesan delivered three oral presentations, highlighting SC3DP's pioneering work in sustainability and advanced additive manufacturing processes on metallic alloys and bio-materials.

Building on the momentum of the conference, Dr. Cagirici and Dr. Daskalakis were also invited to the workshop organised by the International Hellenic University, led by Professor Dimitrios Tzetzis, where they presented SC3DP's research activities and discussed opportunities for joint initiatives. These international engagements not only strengthened our centre's visibility and reputation, but also laid the groundwork for upcoming collaborative projects with global partners, reinforcing SC3DP's role as a leader in shaping the future of additive manufacturing.

Makino AML 500: Powering the Future of Metal 3D Printing with Speed and Precision



A new chapter begins at our centre with the arrival of the Makino AML 500, a state-of-the-art metal 3D printing system. More than just a machine, it brings speed, precision, and versatility to our work. The AML 500 allows us to fabricate functional components, apply protective coatings, and carry out high-quality repairs with remarkable accuracy. Due to its high-speed capability, parts can be produced or restored much faster compared with traditional methods, helping industries save valuable time and resources. This machine, possible through a partnership with Makino Additive Manufacturing, positions us at the forefront of high-value part fabrication and repair, enabling cutting-edge research and real-world applications across aerospace, tooling, and energy sectors.

31st International Conference on Computational & Experimental Engineering and Sciences (ICCES)

On 15 May, Professor Zhou Kun, returned to the 31st International Conference on Computational & Experimental Engineering and Sciences (ICCES) as its Co-Chair, following his highly successful term as General Chair at the previous edition of the conference. Under his leadership, the conference series was transformed, from a traditional mechanics forum with three decades of history, into a cutting-edge global platform at the intersection of mechanics and advanced manufacturing with record-breaking attendance. Covering fields, such as advanced manufacturing and artificial intelligence, the redefined ICCES provides a multidisciplinary platform for researchers and industrial experts around the globe to drive innovation and foster cross-disciplinary collaboration.

International Conference on Materials for Advanced Technologies (ICMAT) 2025

ICMAT 2025
12th International Conference on Materials for Advanced Technologies | SINGAPORE | 30 June – 4 July 2025

The Materials Research Society Singapore (MRS-S) hosted the 12th International Conference on Materials for Advanced Technologies (ICMAT 2025) in Singapore. Since its inception in 2001, this biennial conference has attracted over 25,000 participants and 28 Nobel Laureates. This year, the conference was attended by 2,500 delegates, featured 22 technical symposia, 27 parallel sessions, plenary and theme lectures, keynote and invited talks, poster presentations, exhibitions, and the 14th Joint Asian Meeting on Ferroelectrics and Electroceramics (AMF-AMEC-14).

Among its 22 symposia, Symposium V on Extreme Materials and Systems was chaired by Nanyang Assistant Professor Lai Changquan. ICMAT 2025 served as a premier platform for researchers worldwide, particularly graduate students and early-career scientists, to present cutting-edge work, exchange ideas, and foster global collaborations in materials science and technology.

1st International Conference on Future of AM 2025





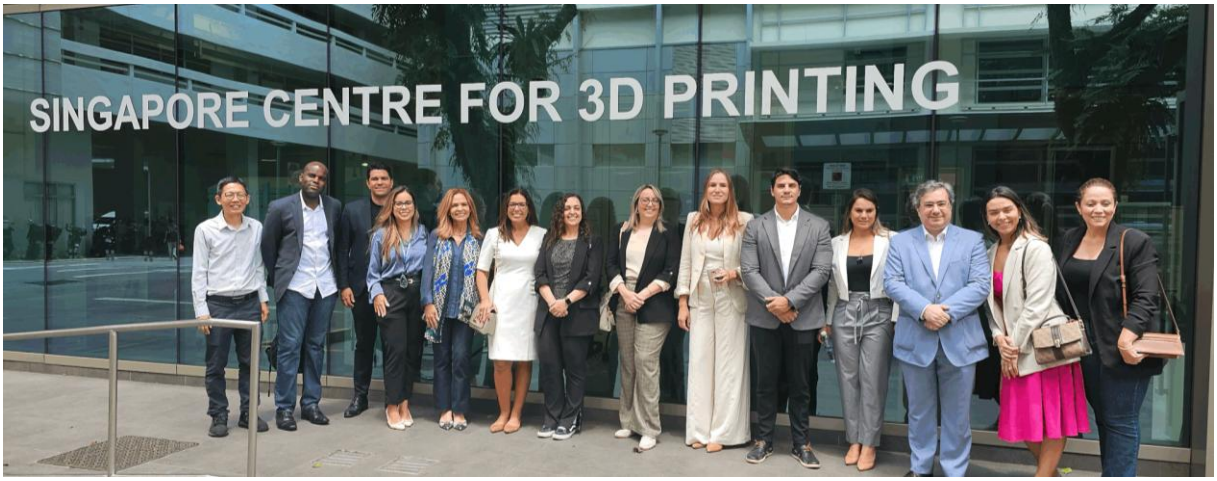
From 5 to 7 August, Professor Yeong Wai Yee chaired the successful 1st International Conference on the Future of Additive Manufacturing (AM) 2025. Centred on the theme "Additive Manufacturing (AM) powered by Artificial Intelligence (AI)", the conference brought together global researchers, industry leaders, practitioners, and students to explore the evolving AM landscape. The conference, which was endorsed by SC3DP, was attended by a large number of members of the centre.

On 5 August, Professor Zhou Kun was invited as a plenary speaker. His talk offered the audience a critical overview of powder-based 3D printing by highlighting key powder bed fusion techniques, emphasising the role of numerical modelling to unravel the complex multi-physics mechanisms, underscoring the application of material and structural design to further expand the capabilities of manufacturing for the next generation.

AI Symposium 2025

SC3DP was invited to the AI Symposium 2025 jointly organised by HUN-REN Hungarian Research Network and NTU Singapore, which brought together researchers, industry leaders, and innovators to explore the latest AI advancements and their real-world impact. Key topics include trustworthy and sustainable machine-learning, advancements in network science, AI in medicine and healthcare, and innovations in industry, vision and robotics.

Strengthening Ties: SC3DP Welcomes Delegation from Brazil



We had the pleasure to introduce our Centre to a delegation from Brazil representing different governmental-related organisations, highlighting our capabilities, and providing a guided tour of our facilities.

It was the second Brazilian delegation this year, demonstrating Brazil's interest in strengthening collaboration with different organisations in Singapore. Additive manufacturing is a rapidly expanding area in Brazil and the opportunities for joint projects are significant.

Tech Spotlight

In July, Stephen Ibaraki, investor/venture capitalist, futurist, serial entrepreneur and global chairman REDDS, interviewed the NTU Vice President for Industry, Professor Lam Khin Yong, and the SC3DP Executive Director, Professor Paulo Bartolo. The interview can be found at

https://stephenibaraki.com/acm/interviews/v0625/lam_khin_yong_acm.html
https://stephenibaraki.com/ieee-tems/interviews/v0625/paulo_bartolo_ieee-tems.html

FEATURED SC3DP'S FACULTY

Professor Tan Ming Jen

- Associate Chair (Faculty) & President Chair in Mechanical Engineering at the School of Mechanical & Aerospace Engineering
- Director, HP-NTU Digital Manufacturing Joint Lab (2018 - Current). (The largest funded Corporate Lab under the National Research Foundation (NRF), Singapore.)

Professor Tan Ming Jen began his academic career focusing on the formability of light alloys, including aluminium, magnesium, titanium, and their composites. At SC3DP, he served as the Founding Programme Director for Building & Construction (2013–2019), at a time when construction-scale 3D printing was still largely unexplored. Over the past decade, he and his research team have collaborated with numerous industry partners to achieve significant breakthroughs. Notable projects include the development of a low-cost toilet for the Indian market (Sembcorp Building & Construction Ltd.), modular bathrooms for public housing (Chip Eng Seng Ltd.), the use of recycled glass as a sand substitute (Mineraltec & Enviro Glass/Australia & NAMIC), and carbon capture in 3D-printed concrete (Aramco).

He has been on the World Economic Forum's (WEF) Global Future Council on Advanced Manufacturing and Value Chains; and on United Nations Environmental Program (UNEP) & World Meteorological Organisation's (WMO) Inter-governmental Panel on Climate Change (IPCC) in 2024.

Associate Professor Tan Lay Poh

- School of Materials Science and Engineering
- Co-Director, Interdisciplinary Collaborative Core (ICC) Office, NTU
- Cluster Lead, Food Research System, NTU

Associate Professor Tan Lay Poh is a faculty in the School of Materials Science and Engineering, Nanyang Technological University, Singapore, and faculty member of SC3DP. Her past work has been focused on tissue engineering and using mechanotransduction to induce differentiation in stem cells as well as designing materials structures and studying the structure-property relationships. With more than a decade of experience in these areas, she is now translating these knowledge into the space of food. She is adopting mechanotransduction strategies to develop cultivated meat without the need of costly and complex differentiation media which is still the main method used by the industry currently. She is also interested in understanding and manipulating the structures-property relationships of materials to develop unique plant-based meat structures using 3D printing.

MOBILITY

SC3DP Welcomed Three New International Students

Philip Everts

Philip is currently undertaking an apprenticeship at the Fraunhofer Institute for Integrated Systems and Device Technology (IISB) in Germany, specialising in electrical systems and device engineering. During his research placement at SC3DP, he focused on bioprinting, with particular emphasis on extrusion-based techniques for fabricating tissue-like structures. He also plays a key role in establishing a partnership between SC3DP and the German company Leistriz.

- Testimonial -

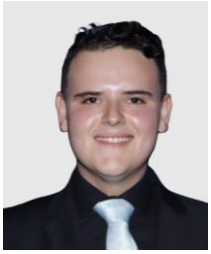
"At SC3DP, cutting-edge 3D printing technologies and collaborative research drive impactful innovation - making it deeply rewarding to be part of this journey."

Jorge Alfredo Estrada Díaz

Jorge is a Postdoctoral Researcher at the Light Materials Unit of the Institute of Advanced Materials for Sustainable Manufacturing, Tecnológico de Monterrey, Mexico. During his research stay at SC3DP, Jorge aims to advance the modeling of frontier additive manufacturing technologies, including L-PBF, DED, E-jet printing, and polymer-based biodegradable and programmable lightweight materials.

– Testimonial –

"At SC3DP, exceptional individuals and frontier technologies synergise to deliver high-impact solutions for industry and society, shaping an experience that has been remarkably enriching."



Srinivas Vudutha

Srinivas is a final-year Aerospace Engineering student at TU Delft, Netherlands. As part of **NTU's Global Connect Fellowship (GCF) research programme,** he joined SC3DP to work on electrospinning and bioprinting bioadhesive wound dressings. His research focused on integrating dual-layered nanofibrous mats with bioprinted scaffolds fabricated using extrusion-based techniques.

– Testimonial –

"SC3DP is shaping the future of medical treatment and beyond through pioneering research and leading 3D printing technologies - making it truly rewarding to be part of this journey."

SC3DP Associated with an Erasmus+ KA171-HED Mobility of Higher Education Students and Staff

Erasmus+

The University of Brescia (Italy) was awarded with an Erasmus+ mobility grant on biomanufacturing. SC3DP is associated with the University of Brescia on this programme and we expect to be awarded with up to 30 mobilities for our researchers and faculties to spend time in different European Universities and vice versa.

SC3DP Was Awarded One HUN-REN-NTU Mobility Grant

HUN-REN – NTU KUTATÓI MI EGYÜTTMŰKÖDÉSI PROGRAM 2025 / HUN-REN – NTU AI RESEARCH COOPERATION PROGRAM 2025
KÓDSZÁM / CALL ID.: HUN-REN – NTU MI KEP 2025 / HUN-REN – NTU AI RCP 2025

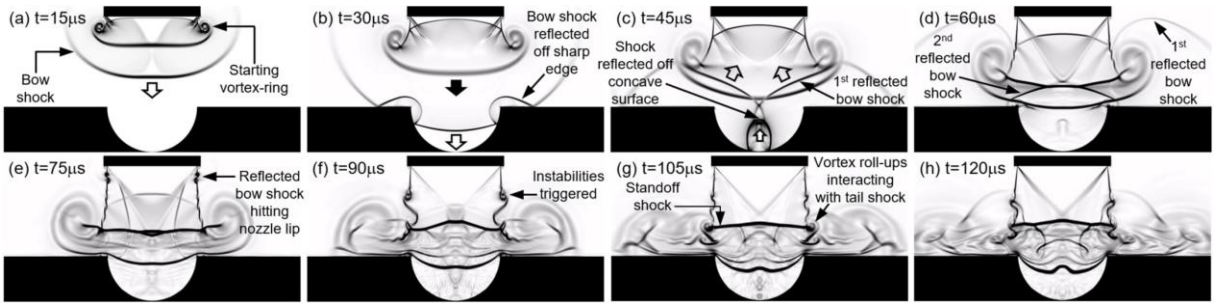
HUN-REN
Hungarian Research Network

A project title "AI-driven Bioprinting" between SC3DP and the Institute for Computer Science and Control (SZTAKI) from Hungary submitted to the HUN-REN-NTU AI research cooperation programme was recently approved. This project integrates machine learning with bioprinting to optimise printability and predict cell viability for fabrication of 3D biomimetic tissues addressing age-related healthcare needs. Aligned with NTU and HUN-REN HQ priorities, it advances AI-driven biofabrication for regenerative medicine.

RESEARCH HIGHLIGHTS

Supersonic starting jet impingements upon hemispherical concavities

Associate Professor Daniel New



Introduction:

Supersonic jet impingement creates complex flow behaviours with shock and vortex formations, as well as significant pressure fluctuations, which are important in applications like propulsion, coating, and surface treatments. While flat-wall impingements are well studied, much less is known about jets interacting with curved or concave surfaces. This study explores how hemispherical concavities of different sizes affect jet behaviour during the early stages of impingement. Using advanced numerical simulations, it reveals how geometry can influence shock patterns, flow stability, and overall jet performance.

Key Highlights:

- Concavity effects on shocks - Smaller concavities (D/d = 0.5 and 1) create more complex shock reflections than flat-wall impingement, but their overall flow behaviour remains similar.
- Flow blockage in large concavities - A larger concavity (D/d = 2) causes major flow blockage, forcing the jet to reverse direction and reducing interaction with flat-wall surfaces.
- Unsteadiness and applications - Variations in concavity size strongly influence shock interactions and flow unsteadiness, with implications for processes like cold spraying on curved geometries.

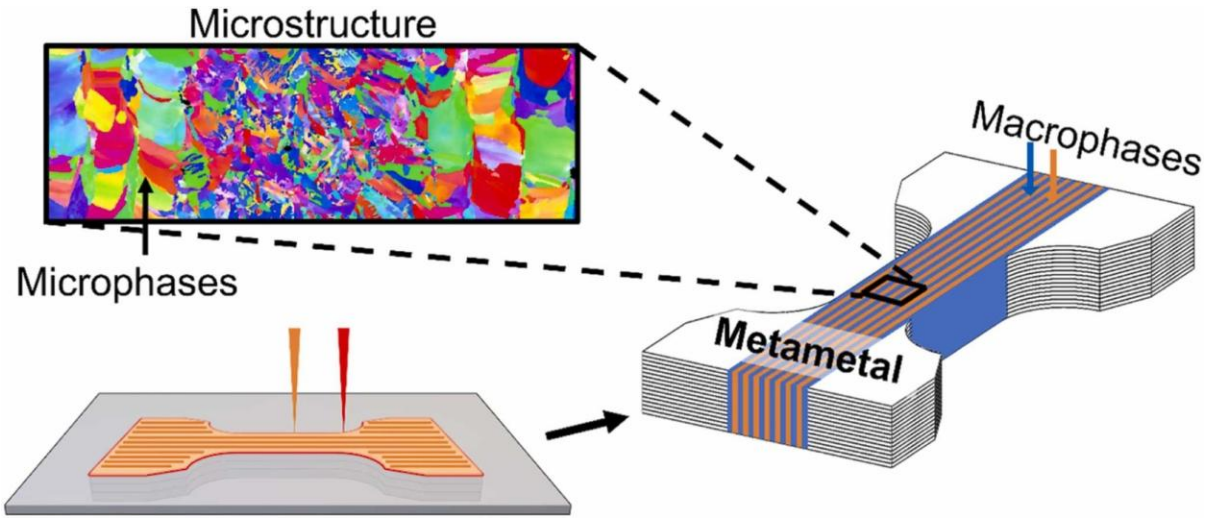
Conclusion:

This numerical study examined supersonic jets impinging on a flat wall and hemispherical concavities with diameter ratios of D/d = 0.5, 1, and 2 using OpenFOAM's rhoCentralFoam solver. Future work will investigate whether such unsteadiness impacts processes like cold spraying on hemispherical surfaces, as well as square bars and channels.

Source: https://doi.org/10.1063/5.0255223

Enhanced strength and delayed necking of architected metametals additively manufactured via laser sheet fusion

Nanyang Assistant Professor Lai Changquan



Introduction:
Additive manufacturing (AM) enables rapid, on-demand production of custom parts by building geometries layer by layer from digital models, overcoming limitations of traditional manufacturing. This approach supports complex 3D designs, including overhangs, and allows for site-specific material properties. For example, in powder bed fusion, adjusting power and scan rates can create varying cooling rates, leading to tailored grain sizes and strengths within a single component. Using a pulsed laser to sequentially weld and cut SS304L sheets, novel metametals with sharp transitions in macrophases (regions with distinct microstructure, morphology and properties) were additively manufactured.

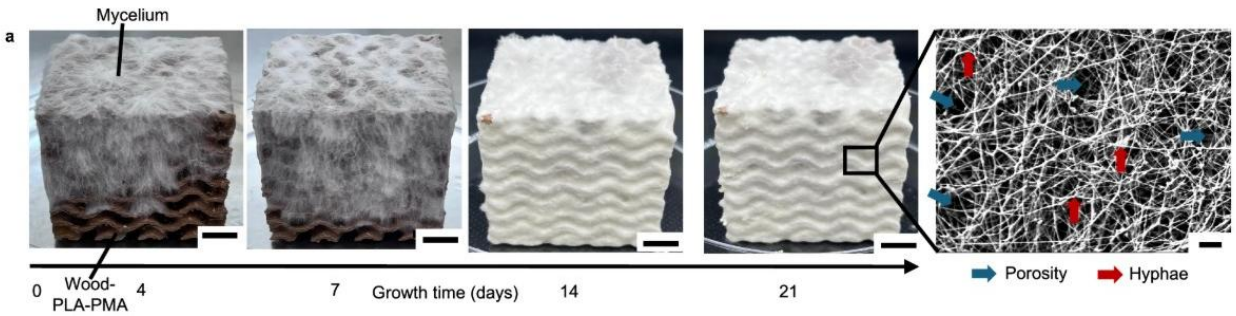
Key Highlights:
- Sheet-based Laser Pulse Integration of Sheets (LAPIS) technique used to tailor microstructures in SS304L 3D prints.
- 3D STRONG, 3D TOUGH and pristine, work-hardened 2D sheet (2DS) macrophases obtained.
- Metametal pairing of 2DS with STRONG or TOUGH extends strength to new limits.
- TRIP of 2DS & TOUGH + interfacial shear stresses → delayed necking in metametals.
- Strength-ductility tradeoff of LAPIS metametals is significantly better.

Conclusion:
A custom additive manufacturing method, LAPIS, was used to create three macrophases in SS304L sheets: STRONG (high strength, 660 MPa), TOUGH (high ductility, 36% via TRIP effects), and the feedstock sheet 2DS (exceptional strength, 1080 MPa but poor ductility). By combining these phases in isostrain configurations, the metametals achieved yield strengths up to 840 MPa while retaining improved ductility. Pairing STRONG and TOUGH with 2DS enhanced uniform deformation and delayed necking through TRIP-induced work hardening, surpassing the conventional strength–ductility.

Source: https://doi.org/10.1016/j.addma.2025.104879

3D printed gyroid scaffolds enabling strong and thermally insulating mycelium-bound composites for greener infrastructures

Associate Professor Hortense Le Ferrand



Introduction:

This study introduces a method to strengthen mycelium-bound composites (MBCs) by growing fungi onto 3D printed wood-PLA gyroid scaffolds. The scaffolds enhance mechanical strength while the mycelium provides additional properties such as thermal insulation, fire resistance, hydrophobicity, and durability. Optimal mycelium growth was achieved at 90% porosity, yielding a thermal conductivity as low as 0.012 W/mK, while strength improvements of up to ~78% were observed at 70–90% porosity. The design-dependent enhancements make these MBCs more viable for practical use, particularly in construction. Overall, the integration of 3D printing and biomaterials demonstrates a promising pathway toward sustainable alternatives to petroleum-based materials.

Key Highlights:

- Mycelium growth across the entire 3D printed wood-PLA scaffold is essential for achieving the desired composite brick properties.
- Growth effectiveness is influenced by the nutrient-rich solution coating composition, unit cell size, and scaffold porosity.
- The gyroid structure was chosen due to its strong mechanical performance, interconnected porous network, and high surface area.

Conclusion:

This study addresses the key drawback of mycelium-bound composites (MBCs)—low mechanical strength and uneven growth - by integrating 3D-printed wood-PLA porous scaffolds. The scaffolds improved stiffness, supported uniform mycelium colonisation, and enabled design-dependent enhancements in strength, thermal insulation, fire resistance, and durability. Results showed performance levels comparable to clay bricks in strength and insulating foams in thermal conductivity, while maintaining sustainability benefits such as low embodied energy and biodegradability in natural environments. Despite modest strength at high porosities and longer production times, MBCs present strong potential as eco-friendly alternatives in construction, packaging, and product design. This work highlights the path toward multifunctional, bio-inspired materials that combine structural stability with sustainable performance.

Source: https://doi.org/10.1038/s41467-025-61369-x

Advanced bioprinting strategies for fabrication of biomimetic tissues and organs

Ng Wei Long, Cian Vyas, Huang Boyang, Professor Yeong Wai Yee and Professor Paulo Bartolo

Overview:

The review paper systematically explores the challenges and design requirements in fabricating three-dimensional (3D) biomimetic tissue constructs. Achieving biomimicry requires not only anatomically relevant structures but also biomimetic microenvironments and vascularization. The paper emphasizes the role of advanced bioprinting strategies in overcoming current limitations, while also examining future directions such as multi-modal bioprinting systems, in-situ bioprinting, and the integration of machine learning (ML).

Key Highlights:

- Advanced bioprinting strategies are crucial for fabricating biomimetic tissues and organs with enhanced functionality.
- The choice of bio-inks and printing methodologies directly influences cell viability and long-term tissue performance.
- Emerging approaches including multi-modal bioprinting, in-situ bioprinting, and ML integration are reshaping the future of tissue engineering and regenerative medicine (TERM).
- From a clinical standpoint, simpler tissue constructs like skin grafts and cartilage implants are already feasible, while the fabrication of fully functional organs such as kidneys and hearts remains a major challenge.

Conclusion:

Bioprinting represents a revolutionary platform for advancing TERM. While significant hurdles remain (ranging from scalability and regulatory approval to the complexity of organ biofabrication), ongoing research and interdisciplinary efforts are paving the way for the realization of personalized, biomimetic tissues with transformative clinical potential.

Source: https://doi.org/10.1088/2631-7990/adeee0

Advanced bioprinting strategies for fabrication of biomimetic tissues and organs

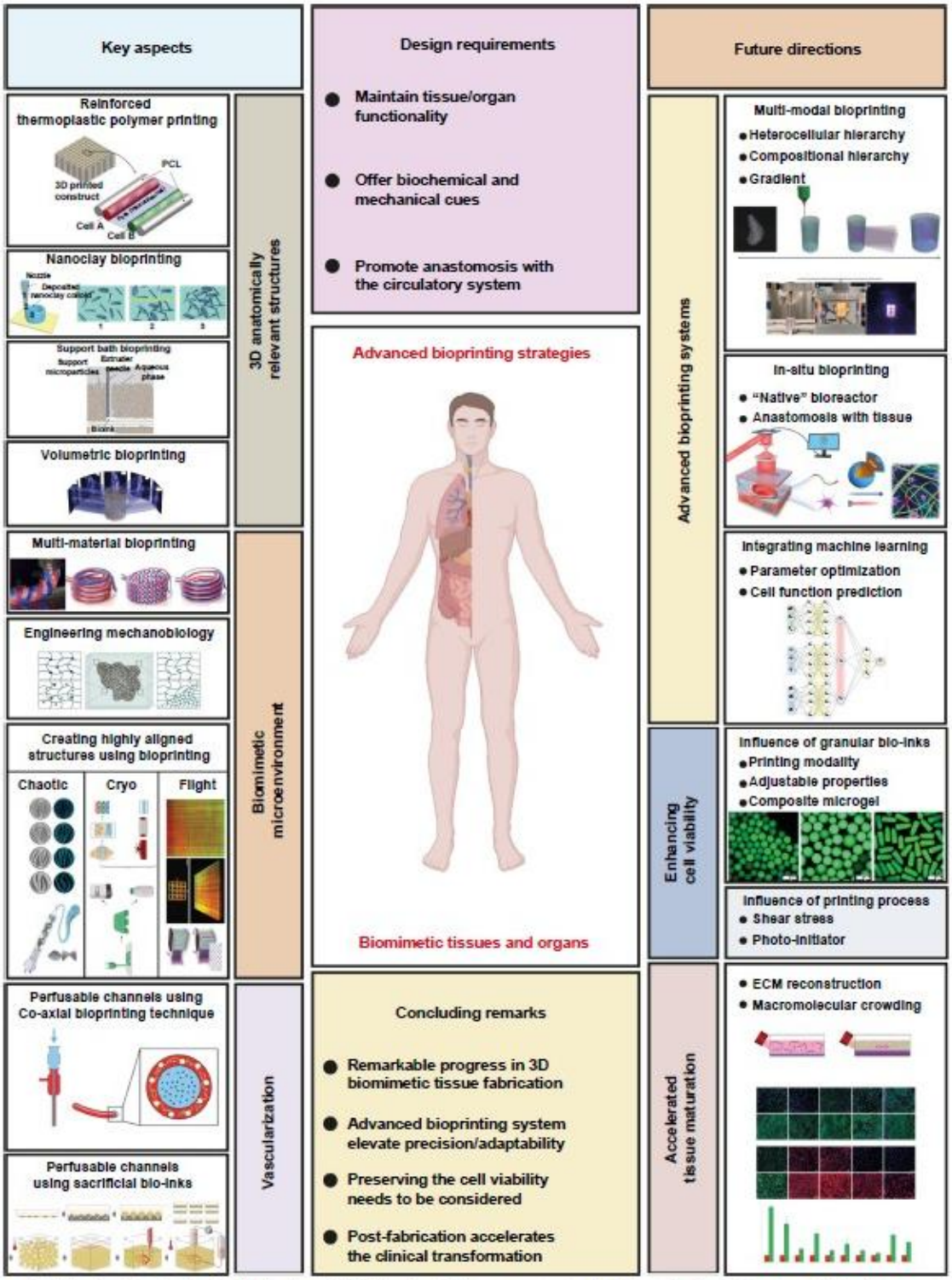


Figure 1. Existing bottlenecks in the fabrication of 3D biomimetic tissue constructs include achieving 3D anatomically relevant structures, biomimetic microenvironment, and vascularization in engineered tissue constructs, which can be potentially solved using advanced 3D bioprinting techniques.

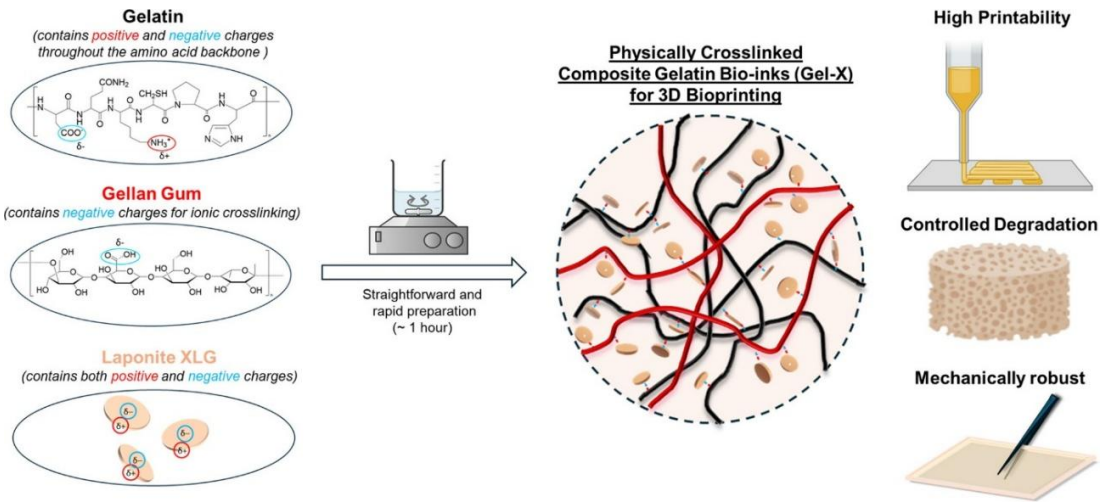
Source: https://doi.org/10.1088/2631-7990/adeee0

Physically crosslinked gelatin bio-inks with enhanced printability, degradation and mechanical robustness for multi-modal bioprinting

Professor Yeong Wai Yee, Ng Wei Long

Overview:

This study presents a sustainable and cost-effective formulation of physically crosslinked gelatin-based bio-inks (Gel-X) composed of gelatin, gellan gum, and Laponite XLG nanoclay. Unlike conventional approaches that rely on chemical crosslinkers, Gel-X bio-inks are prepared within ~1 hour by simple stirring, eliminating the need for photo-initiators or other chemical modifications. The resulting formulation demonstrates superior printability, thermal stability, and mechanical robustness, making it suitable for advanced multi-modal bioprinting applications.



Key Highlights:

- **Enhanced performance:** Gel-X bio-inks overcome the limitations of conventional gelatin inks by providing excellent printability, structural fidelity, and controlled degradation under physiology
- **Mechanical robustness:** Incorporation of Laponite XLG strengthens the gel network, enabling constructs to retain integrity and resist deformation over extended culture periods.
- **Thermal stability:** Unlike pure gelatin, Gel-X bio-inks maintain solid-like behaviour above physiological temperature (37 °C), addressing a key limitation of gelatin-based materials.
- **Biocompatibility:** Cell-laden Gel-X constructs support good proliferation and viability, highlighting their potential for complex tissue engineering applications.

Conclusion:

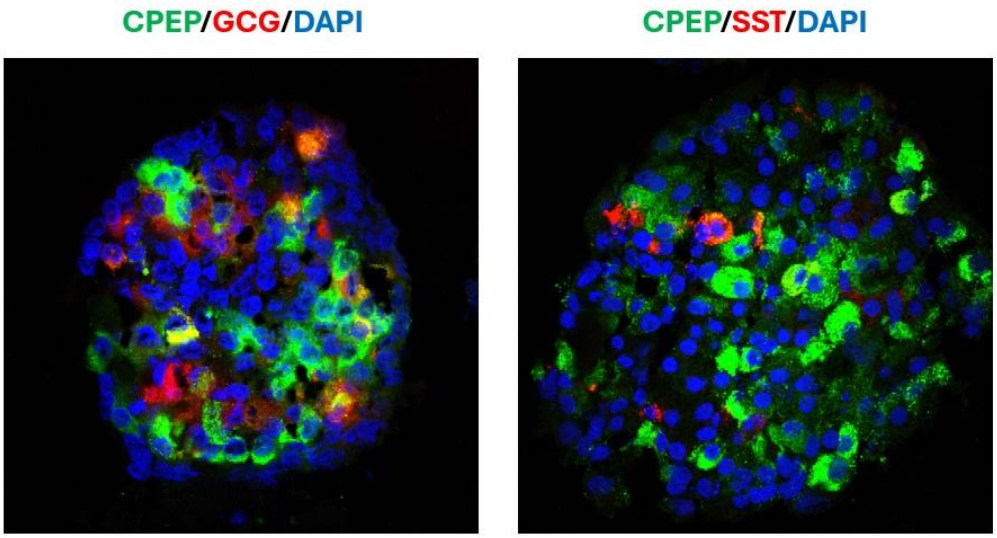
The development of Gel-X bio-inks marks an important step toward sustainable, high-performance materials for bioprinting. By eliminating chemical crosslinking while enhancing mechanical and thermal properties, this work provides a practical and scalable pathway for multi-modal bioprinting. Looking ahead, the approach could accelerate progress toward fabricating robust, cell-friendly constructs for tissue engineering and regenerative medicine.

Source: https://doi.org/10.1002/INMD.20250058

RESEARCH PROJECTS

During the period of this newsletter, we started the following funded projects.

Voxel-like Integration of Bioprinting and Engineered Spheroids (VIBES)for the Fabrication of Pancreatic Islet Model



Description:
Diabetes is a major worldwide disease, >537 million adults live with diabetes (2021), costing an ~USD$966 billion dollars in health expenditure. In Singapore, diabetes affects >500,000 individuals and is the largest single cause of total burden of disease at 10.4 % disability-adjusted life year. Hence, this triggered a 'War on Diabetes' by the Ministry of Health. For Asians with diabetes, there is a more prominent lack of pancreatic islet/beta cell mass and function, predisposing them to develop type 2 diabetes (T2D) more readily. Therefore, restoring insulin secretion and treating T2D by replacing the pancreatic islet/ β cells is crucial.

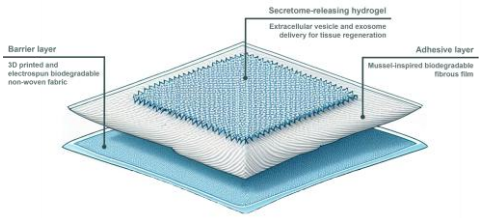
To address this challenge, this project proposes a novel 3D bioprinting concept, enabling the fabrication of a highly vascularised pancreatic islet model for the future treatment of diabetes. Combining 3D bioprinting technology, biomaterials, cells, and other biomolecules, we can fabricate biomimetic, biodegradable, and heterogenous 3D structures, which act as a temporary platform guaranteeing efficient cell viability and normal cellular activities. We will 3D bioprint vascularised human pluripotent stem cell (hPSC)-derived β cell spheroid, cooperatively bioprint a perfusable 3D vascular network, and integrate them into a geometric 3D pancreatic hPSC-derived β cell model. This model will act as an insulin "factory", providing a new solution for future diabetic treatment.

Collaborator: A*STAR Institute of Molecular and Cell Biology (A*STAR IMCB)

RESEARCH PROJECTS

3D Bioprinting Biodegradable Skin Regenerative Wound Dressings

Description:



The worldwide increase in ageing and chronic disease is generating an urgent clinical demand for next-generation wound care solutions, alongside a growing and unsustainable burden of biomedical waste. To break this cycle, new therapies must be both more effective and environmentally responsible. This project pioneers a fully biodegradable and sustainable wound dressing that actively releases a regenerative secretome to accelerate healing. By uniting therapeutic potency with ecological sustainability, it aims to transform wound management.

Collaborator: Inserm (Institut national de la santé et de la recherche médicale)

Fabrication of SiC Ceramics by Stereolithography-based 3D Printing and Carbothermal Conversion of Silica/Acrylate Composite Pastes

Description:

- Optimisation of carbonisation and carbothermal reduction steps to enhance the SiCyield.
- Explore different strategies to improve the density of the SiCceramics to over 85%.
- Evaluate thermal/mechanical properties.
- Printing of end-use demonstrators for testing/validation.

Collaborator: Creatz3D

Clinical LAPIS Additive Manufacturing Technique for Personalized Dental Applications

Description:

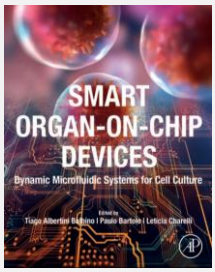
- Lower cost and faster metal 3D printing solution.
- Implants with superior mechanical properties.
- A desktop-sized metal 3D printer without post-processing or an inert gas/ vacuum chamber can be placed within a clinical setting.
- Use metal foil as a precursor material. It is non-flammable, non-toxic, and does not require special storage or personalised protective equipment for handling.
- To validate the application with clinical requirements at National Dental Centre Singapore.

Collaborator: National Dental Centre Singapore (NDCS)

Publication Highlights

During this period, SC3DP's researchers published around 50 papers in leading journals such as International Journal of Extreme Manufacturing (Impact Factor: 21.3), Applied Catalysis B Environmental (IF: 21.1), Nature Communications (IF: 15.7), Journal of Materials Science and Technology (IF: 14.3), Additive Manufacturing (IF: 11.1) and Material Futures (IF: 10.8) confirming the excellence of the research being conducted at the Centre.

New Book



Title: Smart Organ-On-Chip Devices
Edited: Tiago Albertini Balbino, Paulo Bartolo and Letícia Charelli

This book discusses the concepts to engineer functional stimuli responsive organotypic-on-chip devices and its application in several fields, including drug development, disease modeling, personalised medicine, and tissue engineering.

INTELLECTUAL PROPERTY

5 New Technology Disclosure (TD) Submitted

- TD 2024-405: "A Digital Workflow for 3D Printing of Dental Prostheses to Improve Precision and Integration of Multi-Materials", Song Juha, Tan Wen See, Ho Kee Sian Sabrina, Nurul Khadijah Binte Sanusi, Wai Kar Luen, Francis Tan Wee Ming and Chung Wei Xiang Alvin
- TD 2025-17: "Bone Replacement Scaffold Design Chart", Parvathi Nathan, Siaw Meng Chou and Wai Yee Yeong
- TD 2024-212: "Ultronic Evaluation of Tensile Strength for Additive Manufactured Stainless Steel 316L", Tai Junfei and Fan Zheng
- TD 2025-355: "Open-Top Localised Argon Flooding Chamber for Directed Energy Deposition of Reactive Metals", Shubham Chandra and Paulo Jorge Da Silva Bartolo
- TD 2025-366: "Adaptive Thermal Image Enhancement and Temperature Mapping Pipeline Using Classical and Deep Learning Methods", Aryan Dutt, Shubham Chandra and Paulo Jorge Da Silva Bartolo

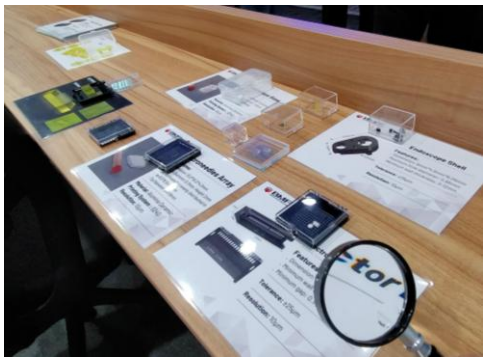
WORKSHOPS AND SEMINAR

Bridging Academia and Innovation with EADA at SC3DP

On 13 May, SC3DP hosted a group of MBA students from the Business School in Barcelona (EADA). The programme featured an introduction by Professor Paulo Bartolo, who outlined SC3DP's major research domains, technological expertise, and industrial collaborations. The highlight of the day was the laboratory tour, where students saw 3D printing technologies in action. The visit offered a unique opportunity to connect academic learning with real-world applications, leaving the students both informed and inspired.

Gain Insights on Projection Micro Stereolithography (PμSL) Technology by Boston Micro Fabrication (BMF) and DASH

On 15 May, SC3DP in partnership with Boston Micro Fabrication (BMF) and DASH hosted an interactive workshop on Projection Micro Stereolithography (PμSL). Researchers and industry participants explored its wide-ranging applications in microfluidics, biomedical engineering, and micro-robotics, while a hands-on session with the BMF system brought the technology to life.



Explore Additive Manufacturing with Technical University of Munich (TUM) Asia



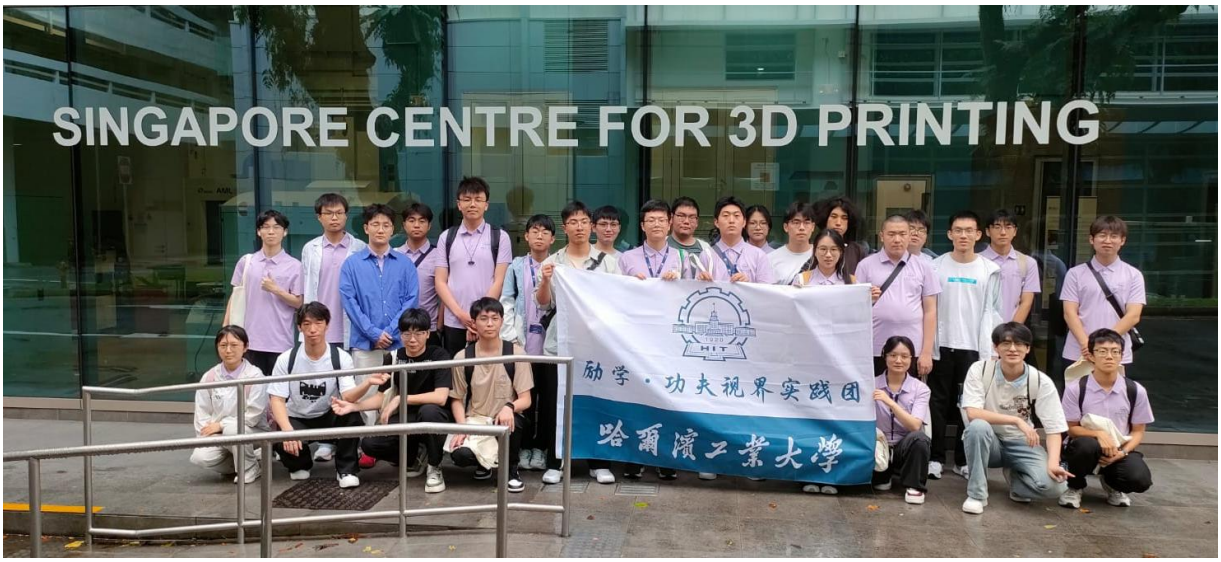
On 10 June, students from Technical University of Munich (TUM) Asia visited SC3DP for an introductory session on additive manufacturing. The session began with a lecture by Professor Paulo Bartolo, who outlined current developments in additive manufacturing and SC3DP's research expertise across Aerospace, Building and Construction, Marine and Offshore, and Biomedical domains.

Professor Michael Schmidt (FAU, Institute of Photonic Technologies, Germany), who was visiting SC3DP as part of a research collaboration between the centre and FAU, delivered a technical presentation on "Understanding the Effects and Potentials of Nano-Additives in NIR Diode-Based PBF-LB/P," based on an ongoing funded project. The visit concluded with a comprehensive laboratory tour.

Seminar on Nozzle Based Additive Manufacturing @ AML

On 19 June, Professor Eleonora Ferraris of KU Leuven, Belgium presented her team's research on Hot Material Extrusion (MEX) and Aerosol Jet Printing (AJP), including pioneering work on collagen printing and 3D bioelectrical interfaces. She also presented innovations in Fused Filament Fabrication (FFF), featuring a patented nozzle design and adaptive strategies for tissue engineering. The seminar further highlighted KU Leuven's Advanced Manufacturing Laboratory (AML) and its significant contributions to materials, processes, and biomedical applications.

Harbin Institute of Technology Visits SC3DP



On 2 July 2025, SC3DP welcomed 40 students from Harbin Institute of Technology (哈尔滨工业大学). The programme began with an overview of the Centre's key achievements and research projects, followed by guided visits to the metal additive manufacturing laboratories and the biomanufacturing laboratory. The visit provided students with first-hand exposure to advanced additive manufacturing techniques and their applications in academia and industry.

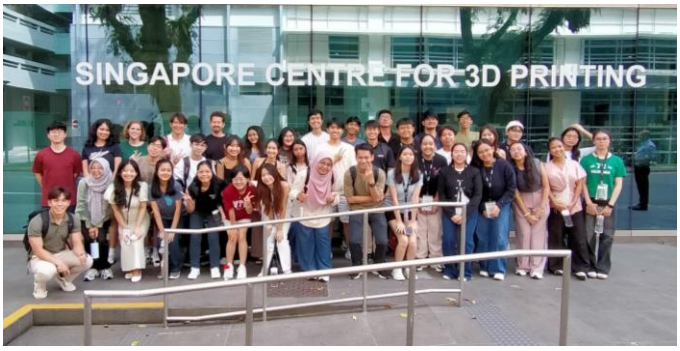
NTU Management Associates

On 2 July, eight Management Associates from the NTU Management Associate Programme (MAP), a two-year leadership development initiative covering two 9-month rotations within NTU's corporate functions, and a 6-month professional attachment to an external organisation, visited SC3DP laboratories for an insightful session. They were introduced to the Centre's milestones and research projects, engaged in constructive discussions, and toured facilities, such as the metal printing and bioprinting laboratories. The session provided valuable first-hand insights into the transformative potential of additive manufacturing.

Yeungnam University College, South Korea

On 8 July, SC3DP organised a visit for students from Yeungnam University College, South Korea. The visit included an overview of the Centre's key achievements and past research projects, and a guided tour of SC3DP's laboratories. The visit provided the students a unique opportunity to explore leading 3D printing technologies and their wide-ranging capabilities.

ASEAN Summer Programme with SC3DP



On 8 July, 40 undergraduate students from ASEAN Universities visited SC3DP as part of their academic programme. The session introduced the centre's innovative technological capabilities and featured an engaging discussion on how emerging 3D printing technologies are transforming industries and driving cross-disciplinary innovation.

3D Printing for Extreme Manufacturing

On 11 July, a webinar focused on the topic of 3D Printing for Extreme Manufacturing, highlighting the potential of Multi-Material Additive Manufacturing (MM-AM). This emerging technique allows for the integration of multiple materials within a single 3D-printed component, paving the way for enhanced functionality, tailored performance, and intricate product designs. Despite its promise, MM-AM also brings notable technical challenges, including material feeding complexity, interfacial defect management, and the need to address differing thermal and mechanical behaviours. Our three distinguished professors also shared their perspectives on the future development and challenges in Additive Manufacturing.

The webinar attracted impressive engagement: Total views: 7,454 | Unique viewers: 6,325 | Peak concurrent viewers: 1,084 | Engagement: 33 questions, 3,699 likes, and 584 shares.

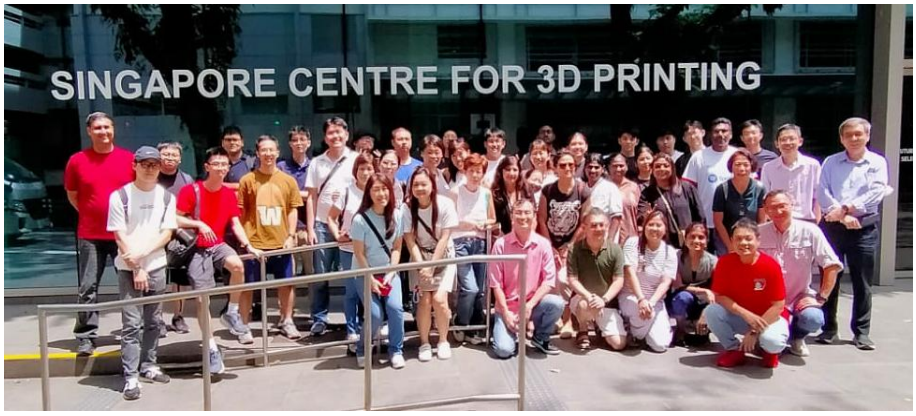
The Fraunhofer Innovation Platform @ The University of Twente

On 17 July, Professor Ian Gibson from the University of Twente, Netherlands, delivered a talk titled “The Long and Winding Road That Leads to Industrial Additive Manufacturing”. He discussed viewpoints on the university’s history, along with its key competencies in manufacturing systems, artificial intelligence, digitalisation, additive manufacturing, and CAx technologies. Professor Gibson also presented several exciting projects led by his team, including work in the aerospace industry, 3D-printed medical implants, and metal multi-material printing and polymer printing.

Inspiring Young Minds with 3D Printing Technology

On 22 July, the Applied Learning Program (ALP) students and teachers from Chung Cheng High School (Main) visited SC3DP. The group toured several of the Centre's facilities, including the ceramic and bioprinting laboratories. The students demonstrated particular interest in the powder bed fusion process, especially how parts are built within the machine. They gained valuable insights into various types of 3D printing technologies, and the benefits for real-world applications.

RSAF's Journey into the Future of Additive Manufacturing



On 31 July, the Air Force Training Command (AFTC) of the Republic of Singapore Air Force (RSAF) visited SC3DP for an interactive session to gain insights into advancements in additive manufacturing (AM) technology. The AFTC team explored a showcase of 3D-printed applications, including unmanned aerial vehicles (UAVs), heat exchangers, and printed circuit boards, highlighting potential uses to support future operational needs in aerospace and defence. During the visit, participants were able to observe SC3DP's advanced infrastructure, including laser powder bed fusion machines, direct energy deposition systems, and biomedical and volumetric printing technologies.

The visit included an observation of SC3DP's advanced facilities, such as laser powder bed fusion machines, direct energy deposition systems, as well as biomedical and volumetric printing technologies.

Seminar on Ultra-Precise 3D Printing with 150 nm Resolution - Technology and Real-World Applications

On 27 August, SC3DP organised a seminar to introduce the IQnano3D printing system, which leverages two-photon polymerization (2PP) technology to produce highly precise micro- and nanostructures with resolutions as fine as 150 nm. Mgr. Ivo Bednář, Chief Sales Officer at IQS nano (Czech Republic), also shared insights on printing processes, such as step-and-repeat, nano-sweep, and other advanced methods. The seminar addressed the development of new materials and their practical applications, with an emphasis on advanced materials and micro or nanoscale technologies, including biomedicine, micromechanics, microfluidics, and photonics.

UPCOMING EVENT/SEMINARS

Industrial Transformation ASIA-PACIFIC (ITAP) 2025

Next-Gen Tech in Manufacturing: The Power of AI, Quantum Computing, 3D Printing & Mixed Reality

- **Event:** Industrial Transformation ASIA-PACIFIC (ITAP) 2025
- **Date:** 15 October 2025
- **Venue**: Singapore Expo

From AI-powered analytics to quantum-enabled problem-solving, additive manufacturing at scale, and mixed reality workforce enablement, this panel discussion will focus on what matters most to strategic decision-makers: business outcomes.
For more information: Registration

Events

- SC3DP Open House - 07 November 2025
- SC3DP 3D Printing Competition - Submission Date: 21 to 22 October 2025 | Result: 7 November 2025

Industry Engagements

- National Additive Manufacturing Innovation Cluster (NAMIC) AM Week (Half day Experiential AM Tour @ NTU SC3DP) - 13 October 2025
- Industrial Transformation ASIA-PACIFIC (ITAP) - 15 to 17 October 2025
- Formnext (The industry hub for Additive Manufacturing) - 18 to 21 November 2025

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