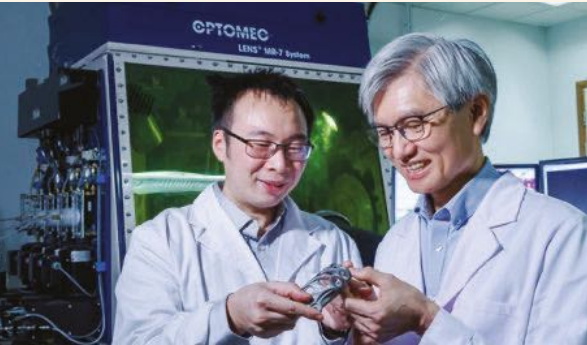


Research & Innovation



High-Performance Titanium Alloys Developed Through Additive Manufacturing

In light of the long-standing challenges associated with quality and waste management that afflict the industrial production of titanium alloys, members of the Research Institute for Advanced Manufacturing,

together with RMIT University and the University of Sydney, have successfully used additive manufacturing, also known as 3D printing, to produce a new strong, ductile, and sustainable titanium alloy – α - β Ti-O-Fe – thus enabling reduced costs, improved performance, and greened waste management.

Through the incorporation of inexpensive and abundant oxygen and iron, the new titanium alloy exhibits increased strength, stability, flexibility, and resistance to corrosion and water. This unlocks an immense potential for accelerating product development and diverse applications from aerospace and marine engineering to consumer electronics and biomedical devices.

Additive manufacturing can also overcome the limitations of traditional manufacturing methods and convert off-grade titanium sponge into raw materials – 10% of the waste generated by the metal alloy production industry can be recycled, significantly lowering both material and energy costs and

Discovery of Nanoscale Ferroelectric New Materials for Computer Memory

Responding to the huge demand for materials with switchable electrical properties for memory applications, a research team from the Department of Applied Physics, in collaboration with researchers from Renmin University of China, the University of Cambridge, and Nanjing University, has discovered nano-sized materials with valuable ferroelectric characteristics that can be reproduced at large scale with unprecedented ease, revolutionising electronics manufacturing.

A one-atom-thick layer of any substance, for example graphene that is made of atomically thin carbon, can have dramatically different properties from the bulk material. Stacking such layers on top of each other can give rise to new properties which do not exist in their individual layers. The team found that bilayer stacks of molybdenum disulphide (MoS_2) and

tungsten disulphide (WS_2) produced at the nanometre scale show an intrinsic ferroelectric property. The electrical polarities of these ferroelectric materials can be reversed by applying a current.



These ultra-thin nanoscale ferroelectrics can be used in sensors, capacitors, and data storage. When manufacture is scaled up, the low cost, low energy demand, and faithful reproducibility of these atomically thin bilayers promises to advance the frontiers of modern electronics. High-tech industries, such as those in the computer memory sector, will benefit from this new class of ferroelectrics.



contributing to environmental sustainability and carbon footprint reduction.

This breakthrough opens up possibilities for holistic and sustainable material design strategies facilitated by 3D printing. In this regard, the team has been **awarded around HK\$3 million** from the Shenzhen-Hong Kong-Macau Technology Research Programme to develop artificial joints for medical use.

Green Antimicrobial Agents and Textiles

The Research Institute for Intelligent Wearable Systems has discovered a series of antiviral and antimicrobial linear aliphatic bio-polyester oligomers that are degradable into water and carbon dioxide, offering greener alternatives in the production of personal hygiene products and medical textiles. These innovative oligomers are much cleaner in comparison to common inorganic and organic antimicrobial agents like silver, copper, and N-halamine, and have significantly lower greenhouse gas emissions than other degradable natural agents such as chitosan.

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Teaching & Learning

Upcycling for Sustainable Future Fashion, Textiles, and Design

The School of Fashion and Textiles co-organised the first Sustainable Future Challenge Competition with Japanese clothing retailer UNIQLO. The competition aims to promote durability and reparability of clothing among young people and foster sustainable development in the fashion, textiles, and design industries. It **attracted more than 120 PolyU students**, while around 10 teams were shortlisted to present their innovative ideas and prototypes to the judging panel.

The winning team took inspiration from traditional Japanese knots and made a series of pet cotton rope toys with considerable business potential, using recycled clothes. The first runner-up team compressed recycled textile waste to make composite boards of outstanding quality, which can be used in the production of furniture, sound absorbing board, and construction materials. Finally, the second runner-up team upcycled coffee ground to fibre for textiles and apparel production, which has a number of unique features such as odour absorption, fast drying, and UV protection.



Eco-Conscious Consumer Behaviour and Travel Practices

The School of Hotel and Tourism Management offers a subject that focuses on the interdependent relationship between consumers and the environment. By acquiring a thorough understanding of what food and accommodation choices are deemed responsible for a better environment, as well as of the contemporary health and safety issues in relation to consumption, students are prompted to make use of the fundamental concepts related to budget-conscious and earth-friendly behaviour to reflect upon their own travelling experience, attitude towards consumption, and their global responsibilities as a consumer and traveller. In this way, they are led to recognising and exercising their power as a responsible global citizen in promoting dignified life and justice in the world.

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Outreach & Engagement

Reducing Good Waste and Advocating Upcycling

The School of Design (SD) has collaborated with Rooftop Republic and Garage Academy to host a hands-on workshop on composting practices for **about 50 householders, educators, and school managers**, where they learned about challenges related to local food waste, explored urban rooftop farming, and were taught how to introduce bokashi fermentation practices into everyday life by upcycling locally sourced materials.



Zero Waste Festival

Additionally, together with GREEN Hospitality and Zero Foodprint Asia, the School facilitated the “Zero-Waste to Landfill for the F&B Industry” information booth at the Zero Waste Festival in Central Market which **attracted around 500 visitors**. They organised an interactive bokashi upcycling workshop to educate the public about waste segregation and zero-smell decomposition in urban kitchens, highlighting the importance of zero-waste living and the role local farming plays in urban organic waste reintegration.

SD has also partnered with Hong Miu Organic Farm and Zero Foodprint Asia to organise a work-integrated education day on a farm for **over 30 hospitality professionals** focusing on the day-to-day reality of local agriculture and how local hoteliers can help agriculturists in tangible ways. Participants were introduced to the process of soil health proliferation through mulching application and nutrient upcycling with composting and took part in communal potato planting. They were also demonstrated the environmental challenges of conventional farming techniques and learned about regenerative farming approaches and their eco-social benefits.



Zero Waste Festival



Supporting Green Innovation and Technology Start-Ups

In an effort to support start-ups in commercialising innovation and technologies related to energy efficiency and carbon reduction, the Knowledge Transfer and Entrepreneurship Office this academic year jointly organised “Hang Seng x PolyU Sustainable Future Challenge 2022: Textile and Fashion” in association with Hang Seng Bank. Aiming to co-create and explore solutions to further enhance industry

sustainability through innovation and technology, the competition **attracted over 300 PolyU students, research postgraduates, entrepreneurs, and members of the public** to participate and provide solutions on recycling textile waste, and transforming and reusing discarded clothing. Over HK\$730,000 was disbursed to winning teams. In parallel, the Office also **supported nearly 50 green tech start-ups** to the tune of more than HK\$1.7 million through other University funding programmes.

Governance & Operations

University Community Sustainable Engagement Programme

To encourage active involvement of PolyU members in sustainable campus development and carbon neutrality efforts, the Campus Facilities and Sustainability Office launched GreenCoin, a mobile application for users to earn virtual coins by participating in sustainability activities, such as recycling at reverse vending machines (RVMs) and joining “Bring Your Own” (BYO) initiatives. GreenCoin aims to promote positive environmental values and advocate a more sustainable lifestyle among students

and staff, who can use the coins to redeem e-coupons for various on-campus services, including free booking sessions for sports facilities. In this academic year, **around 5,000 new users** registered on GreenCoin, while **over 200,000 recyclable items have been collected** via the RVMs and **approximately 30,000 instances of BYO practices** recorded. GreenCoin users are also invited to engage in green living and earn rewards through several signature sustainability initiatives, including Low Carbon Dining Week, Campus Sustainability Week, and urban farming. Furthermore, food waste sorting and recycling counters have been set up in designated catering outlets on campus to educate the University community and facilitate after-meal recycling. In this

academic year, **over 230 tonnes of municipal solid waste disposal to landfill were reduced**.

