

Forging new paths at the intersection of chemistry and materials science

Close to 1,000 scientists attended the virtual Distinguished Lecture Series on Chemistry organized by the Hong Kong Institute for Advanced Study (HKIAS) at the City University of Hong Kong (CityU) during March and April 2021. Discussion topics ranged from the future of printable solar-cell technologies to the role of nanomaterials in developing clean energy solutions.

According to metrics compiled by Stanford University, CityU has over 140 full-time faculty members—eight of whom are HKIAS members—listed among the top 2% of the world's most highly cited scientists, reflecting its excellent academic stature.

Among them are Sir Colin Blakemore, Philippe G. Ciarlet, Way Kuo, Chain-Tsuan Liu, Jian Lu, and David J. Srolovitz (listed alphabetically), who are senior fellows of HKIAS; Tei-Wei Kuo, former visiting fellow of HKIAS; and Jacob C. Huang, executive director of HKIAS. The three speakers of the HKIAS Distinguished Lecture Series on Chemistry are also listed.

A printable green energy source

On March 3, 2021, Alex Jen, Lee Chau-kee Chair Professor of Materials Science and Chair Professor of Chemistry and Materials Science at CityU, delivered a lecture titled "Printable Solar Cells for Transformative Clean Energy and Sustainable Society."

"Solar power is a potential sustainable solution because it can generate the largest amount of energy," said Jen. "The question is 'do we have enough devices to store or generate the power?'"

He introduced printable solar cells—an innovative energy-saving application—highlighting the advantages of organic solar cells and perovskite solar cells as two significant printable materials with immense potential. Barriers to their application, and possible solutions, were also discussed.

"The applications for printable solar cells are broad, including wearable gadgets and portable power sources," he said, expressing his hope that printable solar cells will be easy to scale up, comparable to printing a newspaper.

The future of nanomaterials

In the second lecture of the series, on March 31, 2021, Hua Zhang, Herman Hu Chair Professor of Nanomaterials at CityU, delivered a lecture titled "Phase Engineering of Nanomaterials (PEN)."

Zhang reviewed his group's recent research on PEN, published in *Nature Reviews Chemistry*, which focuses on the rational design and synthesis of novel nanomaterials with unconventional phases for various promising applications.

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Hua Zhang



Alex Jen



Chun-Sing Lee

In response to a question about how nanomaterials are synthesized, he stressed that conventionally, the control of composition, morphology, size, dimension, and facet is important. By contrast, his group focuses on the phase control of nanomaterials, particularly unconventional crystal phases and amorphous structures.

"Although PEN is still under development, it's an important topic," said Zhang. "Its future applications are diverse, such as in catalysis, surface-enhanced Raman scattering, waveguides, and clean energy."

Finding new material properties

In the final lecture, on April 8, 2021, head of the CityU chemistry department and Chair Professor of Materials Chemistry Chun-Sing Lee delivered a lecture titled "Charge-Transfer Complexes and Their Applications."

Lee described charge-transfer complexes (CTCs): "People define CTCs in different ways, but there is still no agreed-upon definition," he explained. Adopting a simple definition, he called CTCs "a substantial charge transfer between donor and acceptor that achieves different properties from the parents."

Characteristic signatures of CTCs, such as a red-shift and broadened emission and absorption, were introduced. Lee also highlighted how CTCs enhance solar cells and LEDs when applied to these devices. Additionally, he described their wide application in optoelectronic devices, biomedicine, and energy and environment, providing relevant examples.

"The formation of CTCs is a simple way of getting new and unconventional properties from organic materials," he said, stressing their exciting potential in novel applications.

This lecture series at HKIAS is supported in part by the Kwang Hua Educational Foundation, which brings the work of its internally acclaimed scholars to a wide audience of young researchers in order to deepen the academic community's understanding of key areas of scientific endeavor.



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