



Preparing for tomorrow with materials today



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Abstract

Throughout history, new materials have been the foundation of disruptive technologies. From bronze, paper, and ceramics to steel, polymers, and semiconductors, each material enabled far-reaching advances and defined the era. Seventy years ago, the synthesis of pure semiconductors as single crystals led to a complete transformation of the electronics industry and sweeping changes in communications, computing, and transportation. Today, inspired by the United Nation's Sustainable Development Goals (SDGs) – a blueprint to achieve a better and more sustainable future for all – another new class of materials is emerging—one with both the potential to alleviate environmental burden, provide radically new functions, and to challenge our notion of what constitutes a “material.” These materials, inspired and co-opted from biology, combine (1) hybrid composite design, combining disparate building blocks; (2) compartmentalized architecture, encapsulating desirable biomolecules while excluding others; and (3) hierarchical organization. Together, they enable unique and remarkable combinations of properties, including adaptability, plasticity, multi-functionality, and environmental responsiveness – far beyond those achieved by monolithic materials of the synthetic world. An extraordinary example is pollen, a discrete mesoscale compartment, which encapsulates, protects, and transports male genetic material in flowering plants enabling the biological imperative of reproduction. In this talk, I will introduce our ongoing efforts to explore the materials science of pollen and to transform pollen into a valuable commodity to produce pollen-based materials innovation as a sustainable solution to numerous outstanding environmental challenges. Key examples that will be covered include digital printing of shape-morphing materials, recyclable and reusable paper, and oil-absorbing sponges.

Biography

Professor Nam-Joon Cho is the President's Chair Professor in the School of Materials Science and Engineering at NTU, and Director (Flagship Programmes) in the President's Office. A Stanford- and UC Berkeley-trained scholar, he leads internationally recognised research at the intersection of materials innovation, sustainability, and healthcare — from broad-spectrum antiviral technologies funded by the US NIH to bio-derived nature materials that replace plastics. Author of over 320 papers including Nature and Science journals, his work has attracted more than S\$35 million in competitive funding and translated into licensed technologies and spin-outs. A dedicated educator and mentor, he also champions cross-disciplinary collaboration through NTU's “Cross Economy” vision.

*** ALL ARE WELCOME ***

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