MIT Industrial Liaison Program Faculty Knowledgebase Report

Mining Technologies, Part 1: Tailings

November 18, 2020 10:00 am - 12:00 pm

10:00am - 10:50am	Biological Recovery of Metals from Mine Tailings Angela Belcher James Mason Crafts Professor of Biological Engineering and Materials Science and Engineering Angela Belcher James Mason Crafts Professor of Biological Engineering and Materials Science and Engineering Angela Belcher is a materials chemist with expertise in biomaterials, biomolecular materials, organic-inorganic interfaces, and solid-state chemistry. Her work focuses on evolving organisms to build new materials and devices for clean energy, electronics, the environment, and medicine. Belcher was awarded the 24th annual MacArthur Foundation Fellowship, the 2004 Four Star General Recognition Award, and was named the 2006 Scientific American's Research Leader of the Year. Her work has been published in many prestigious scientific journals, including Science and Nature, and has been reported in the popular press, including Fortune, Forbes, Discover, The New York Times, and The Wall Street Journal. Belcher holds a BS in creative studies and PhD in inorganic chemistry from the University of California at Santa Barbara. View full bio

10:50am - 11:40am

Turning waste to value
Markus J. Buehler

Jerry McAfee Professor of Engineering, MIT Department of Civil and Environmental Engineering and MIT Department of Mechanical Engineering

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Dr. Markus J. Buehler, Jerry McAfee Professor of Engineering at MIT, is a leading researcher in computational modeling across domains, from materials to biology to physics. Markus' expertise bridges AI to multi scale materials modeling. He recently co-developed a method that uses artificial intelligence to generate new protein designs with specific strengths, mimicking natural materials like silk. This approach, which uses computer simulations for testing, allows the creation of proteins with desired mechanical properties, such as strength and flexibility, beyond what is naturally available. Markus earned a Ph.D. at the Max Planck Institute for Metals Research at the University of Stuttgart and held post-doctoral appointments at both Caltech and MIT. Buehler has received many awards, including the Feynman Prize, the Drucker Medal, and the Washington Award. He is a member of the National Academy of Engineering.

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What if we could design materials that integrate powerful concepts of living organisms – self-organization, the ability to self-heal, and an amazing flexibility to create astounding material properties from abundant and inexpensive raw materials? What if we could turn waste into functional materials? This talk will present a review of bottom-up analysis and design of materials for various purposes – as structural materials such as bone in our body or for lightweight, strong and resilient composites, for applications as coatings, and as multifunctional sensors to measure small changes in humidity, temperature or stress. These new materials are designed from the bottom up and through a close coupling of experiment and powerful computation as we assemble structures, atom by atom. Materiomics investigates the material properties of natural and synthetic materials by examining fundamental links between processes, structures and properties at multiple scales, from nano to macro, by using systematic experimental, theoretical and computational methods. We review case studies of joint experimental-computational work of biomimetic materials design, manufacturing and testing for the development of strong, tough and mutable materials for applications as protective coatings, cables and structural materials. We outline challenges and opportunities for technological innovation for materials and beyond, exploiting the use of artificial intelligence as a way to complement conventional physics-based modeling and simulation methods. Altogether, the use of a new paradigm to design materials from the bottom up plays a critical role in advanced manufacturing, providing flexibility, tailorability and efficiency. A few case studies are presented including work with wood waste, algae, sewage sludge and other low-value waste streams that are turned into high-fidelity material platforms using our innovative deep-learning enabled multiscale modeling and experimental platform.

11:40am - 11:50am

Startups Lightning Talk

- Phoenix Tailings: New metals & metal powders from re-mined discarded ore

11:50am - 12:00pm

Startups Lightning Talk

Gradiant Video time stamps starts at: 8:44???????

- Gradiant: Tailored, innovative approach to treat complex water & wastewater challenges