

Sustainable Production / Circular Economy

Session Co-Chairs:

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Abstract

While sustainability and circular economy methods are increasingly being adopted by the scientific communities and industries across the world, the concept of circular economy has always been fundamental to our lives - by eating last night's leftover food for lunch, or by repurposing old clothes into household products, we embrace a sustainable way of life through circular economy. Circular economy is a model of production that celebrates reusing goods and products for the greater good - for instance, tackling global challenges like waste, pollution, bio-diversity loss, or climate change. A circular economy reduces primary material use, redesigns materials to be less resource intensive, and recaptures post-consumer products and waste as a resource to manufacture new materials and products. In this session, we will look at sustainable production and circular economy through the lenses of four different industries, i.e., metals, plastic, batteries, and construction/biomass. The first topic will introduce and discuss the concepts of dissipation and of downcycling, the phenomenon of quality reduction of materials reprocessed from waste relative to their original quality (e.g., due to alloy materials), and how use downcycling quantification to help define a framework to keep materials in the loop longer, i.e., to use materials more often and at higher quality. Next, we will learn about processing and characterization methods for sustainable (recycled and renewable) plastics and advanced composite materials. Then, we will switch our focus to the automotive industry and the increasing adoption of Lithium-Ion Batteries in electric vehicles which, while potentially reducing our fossil fuel dependency and overall CO2 emission in the environment, increase our dependency on precious metals (Lithium, Cobalt, Nickel, etc.) and pose us with the challenge of responsibly disposing, repurposing and recycling these batteries at end of life. The third topic of the session will discuss state-of-the-art electric vehicle battery recycling technologies and their tradeoffs between scalability, energy efficiency, processing cost and environmental impact. The fourth and final topic will introduce and discuss the concept of upcycling plant-based waste products and turning them to ecological circular products particularly for the resource- and emission intense construction industry with the aid of fungal mycelia as natural binder. At the end, we will have a moderated Q&A session where we will jointly explore the challenges and commonalities faced by these different industries in their sustainable production and circular economy practices.

Speakers

Global Cycles of Metals and Minerals

[Christoph Helbig](#), University of Bayreuth

Plastic Waste Management and Recycling

[Alper Kiziltas](#), Amazon Lab 126

Scalable and Sustainable Recycling of Electric Vehicle Batteries

[Zheng Chen](#), University of California, San Diego

Rethinking Buildings: Alternative Construction Materials

[Nazanin Saeidi](#), Karlsruhe Institute of Technology