Reversible interfaces for stretchable and recyclable electronics

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11:00am, 18/11/2022
At the Melbourne Centre for Nanofabrication Boardroom
151 Wellington Road, Clayton, 3168
Zoom link: here
Meeting ID: 839 3750 1277

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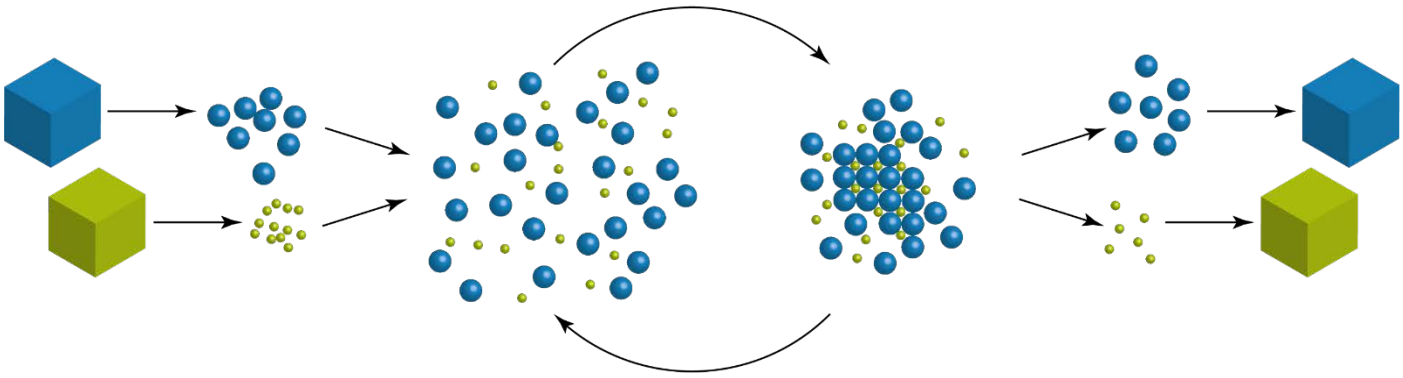
Abstract:
Soft electronic composites retain their electrical conductivity under strain. Hard, conductive filler particles are embedded in a soft, insulating matrix. Strain deforms the filler network and alters the conductive connections between the particles. I will discuss the hierarchical network structure of carbon and metal fillers in printable conductive composites and discuss the role of network geometry and contact resistances. Reversibility at the particle-particle interfaces emerges as a key requirement: only if the particles can re-form electrical contacts over many cycles does the material retain its conductivity. An application from the field of smart automotive parts will illustrate typical requirements on soft conductive materials.

Reversible interfaces aid the recovery of the materials in a product's lifecycle, too. Electronics and batteries invariably combine different materials, and their reuse or recycling generally involves separating them. I will discuss how reversible, functional interfaces can make this economically and ecologically feasible and bring us a step closer to sustainability in electronics.



Prof Dr Tobias Kraus is a chemical engineer and materials scientist trained at TU Munich, MIT, and the University of Neuchâtel. He obtained his PhD at ETH Zurich and the IBM Research Laboratory, where he worked on the assembly of particles at interfaces, particle transfer through controlled adhesion, and the creation of functional interfaces and structures with particles.
Today, Tobias works at the INM – Leibniz-Institute for New Materials in Saarbrücken, Germany. He has been head of the Program Division "Structure Formation" since 2014. In 2016, he became full professor for colloid and interface chemistry at Saarland University, where he teaches and supports the strong collaboration between INM and University.
In his research, Tobias curtails the interactions between particles, polymers, and small molecules. This leads to predictable, hierarchical assemblies for structured interfaces and functional materials. His group investigates hybrid materials for flexible and transparent electronics, reversible interfaces for soft and recyclable electronic devices, optical sensors, and their formation during 2D and 3D printing. Fundamental problems of nanoparticle structure, network formation, and self-assembly are investigated with a combination of small-angle X-ray scattering, light scattering, electron microscopy, and optical spectrometry. The group establishes analytical and digital models of structure formation and applies them for the creation of new materials with rationally designed morphologies.