Seminar:

Computational modeling of fiber ensembles in structural batteries and flexible electronics

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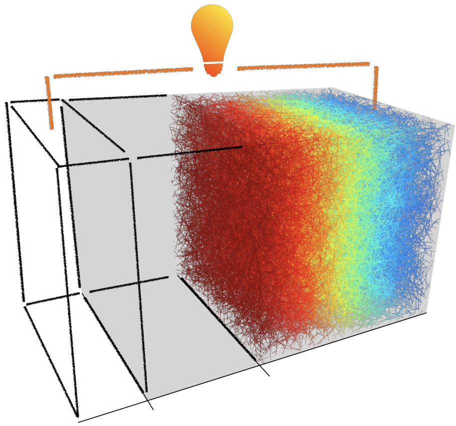

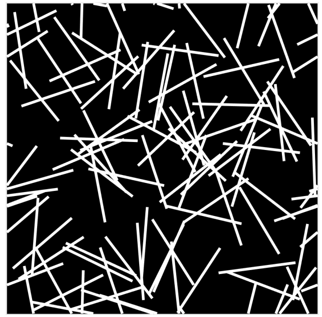

The shortage of raw materials and the growing demand for energy are global issues that call for renovated design of energy storage and electronic devices. Among the various solutions currently under investigation, structural batteries and metal nanowire electrodes are quickly emerging, and they share two key features. First, one-dimensional elongated objects (either fiber or nanowires) are at the core of the device concept. Second, since mechanical loads are applied on the devices during service, stress and deformations affect the response of the constituents and the performance of the device in turn. Structural batteries are rechargeable batteries capable to bear mechanical loads. As they can be embedded in the structure of the device they supply, an enhanced energy-to-weight (energy-to-volume) ratio of the overall device can be achieved. Metal nanowires represent a viable replacement to thin films for the production of transparent electrode employed in displays. Thin film electrodes currently rely on material which are scarce, expensive, and brittle, and therefore not suitable for a cost-effective production of flexible electronics.

On the one hand, the ‘fiber-based’ structure offer advantages in terms of multifunctionality, load bearing capability, and flexibility. On the other hand, the heterogeneous structure poses serious design challenges. The interrelation between electrochemical (or electrical) and mechanical process further complicates the overall picture. Computational modeling approaches are set up to attain efficient simulation tools to support the design process of structural batteries and metal nanowire flexible transparent electrodes.