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**Harder, Cheaper, Greener: The Materials Science of Nanostructured Metal Coatings**

In Materials Science and Engineering, basic scientific principles can lead directly to new engineering products that are better, cheaper, and greener. Prof. Schuh will describe the connection between scientific thinking and engineering practice in the area of metal coatings, used on products ranging from automotive to consumer electronics. More specifically, he will address the replacement of legacy technologies, which have significant environmental drawbacks, with a new class of greener coatings. To do so requires new alloy-design science to control and thermodynamically stabilize material structure at the nanometer-scale.

**Materials Entrepreneurship: Nanostructured Metal Coatings as a “Platform Technology”**

Every engineering industry relies on materials, and conversely, most materials are used in multiple application spaces. This can be a great strength for Materials Science and Engineering when it meets the marketplace. In this second lecture Prof. Schuh will discuss the “platform technology” attributes of nanocrystalline coatings. Beginning from the basic scientific notion of thermodynamically stabilized nanostructure, a number of parallel development trajectories will be charted. This includes the use of nanostructure control to address different application spaces, the development of new alloy coatings for new applications, and the optimization of hierarchical coating structures from the nano- to the macro-scales.

**Materials Scale-Up Science: How Thermodynamics Enables Mass Manufacturing of Bulk Nanostructured Metals**

Because nanostructured metals have exceptional properties, they are of high interest for engineering components of myriad sizes, shapes, and functions. Unfortunately, most scalable processing technologies for metal parts are close to equilibrium, while nanostructured metals are usually far from it. In this third lecture Prof. Schuh will discuss how the concept of thermodynamic stabilization opens the possible processing pathways—and therefore the manufacturing scalability proposition—for nanostructured metals. Specifically, he will address the design of alloys for thermal stability and rapid processability in a nanostructured state. The possible application trajectory will also be outlined, from premium machine components to a new generation of metal additive manufacturing by 3D printing.