McCormick

Northwestern Engineering

Materials Science and Engineering

THE 2015 MORRIS E. FINE LECTURE

Christopher A. Schuh

Danae and Vasilis Salapatas Professor of Metallurgy,
Head of Materials Science and Engineering
Massachusetts Institute of Technology

Tuesday, February 24, 2015
4:00pm, Tech L361

Reception to follow for all attendees:
5:00pm-6:00pm, Willens Wing Atrium

"Grain Boundary Alloying in Nanocrystalline Metals, from Theory to Practice"

When the grain size of a metal is refined to a scale on the order of just a few nanometers, its strength, hardness, wear resistance, and other properties improve in dramatic ways. There is therefore significant interest in designing and deploying such nanocrystalline alloys for structural applications. However, refining the grain structure is a struggle against equilibrium, and nanocrystalline materials are usually quite unstable; the grains grow given time even at room temperature, and the associated property benefits decline over time in service. The future of nanocrystalline materials therefore lies in stabilizing their structure, which in turn expands their processability and opens the door to application-relevant service lifetimes. This talk will review the concept of grain boundary alloying as a method to lower the energy of grain boundaries, which can bring a nanocrystalline structure closer to equilibrium and stabilize it for engineering use. The pathways from theory, to proof-of-concept laboratory demonstration, to scale-up and commercialization of such alloys will be highlighted. The current applications and future prospects of stable nanocrystalline metals will be described, including as substitute materials to reduce cost and cost volatility, as greener alternatives to legacy technologies, and as next-generation structural materials with large performance increments over incumbent metals.

Biography:

Christopher A. Schuh is the Department Head and the Danae and Vasilis Salapatas Professor of Metallurgy in the Department of Materials Science and Engineering at MIT. He joined MIT in 2002, having received a B.S. degree at the University of Illinois at Urbana-Champaign, and a Ph.D. at Northwestern University, both in the field of Materials Science and Engineering. Prof. Schuh also held the Ernest O. Lawrence postdoctoral fellowship at Lawrence Livermore National Laboratory. Prof. Schuh's research is focused on structural metallurgy, and seeks to control disorder in metallic microstructures for the purpose of optimizing mechanical properties; much of his work is on the design and control of grain boundary structure and chemistry. Prof. Schuh has published more than 200 papers and dozens of patents, and received a variety of awards acknowledging his research accomplishments. He co-founded Xtalic Corporation, a technology spin-out company that has commercialized a new process for dynamically controlling the nanostructure in electrodeposited metals, with applications ranging from automotive and machine components to electronics. Prof. Schuh has been named a MacVicar Fellow of MIT, recognizing his contributions to engineering education, and was recently elected a Fellow of The Minerals, Metals, and Materials Society.