Prof. Hanchen Huang, FASM
Dean of the College of Engineering, Architecture and Technology
Donald and Cathey Humphreys Endowed Chair Professor
Oklahoma State University
Stillwater, OK
Trustee (2023-2026)

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Hanchen Huang is the Dean of the College of Engineering, Architecture and Technology at Oklahoma State University. As an academic leader, he has served as the program director of mechanical engineering at Rensselaer Polytechnic Institute, department chair of mechanical and industrial engineering at Northeastern University, college dean of engineering at the University of North Texas, and provost at the University of Massachusetts Dartmouth.

Academically, Hanchen Huang is the Donald and Cathey Humphreys Endowed Chair Professor at Oklahoma State University. He has served as a Connecticut Clean Energy Fund Endowed Professor at the University of Connecticut, Donald Smith Endowed Professor at Northeastern University, and Lupe Murchison Foundation Endowed Chair Professor at the University of North Texas. In addition, he has been a Royal Society of London KTP Visiting Professor at the Hong Kong Polytechnic University and a Hsue Shen Tsien Engineering Science Visiting Professor at the Chinese Academy of Sciences Institute of Mechanics.

In professional societies, Hanchen Huang is an elected fellow of four professional societies: the American Association for the Advancement of Sciences (AAAS), American Society for Materials International (ASM), American Society of Mechanical Engineers International (ASME), and Society of Engineering Science (SES). In addition, he is an elected member of the Connecticut Academy of Science and Engineering, and a senior member of Sigma Xi – the Scientific Research Honor Society and of the Chinese Mechanical Engineering Society. He currently serves as a member of the Board of Trustees of the American Society for Materials International (ASM), and has been a member of the Advisory Board of the NiHao Food Bank Initiative in partnership with the North Texas Food Bank.

Abstract: Why Are Metallic Nanorods Nano?

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Abstract:

Metallic nanorods from physical vapor depositions are nano in diameter. What is the origin of the nano scale? This seminar presents an answer to this question. We hypothesize that the scientific origin of the nano scale is surface diffusion kinetics, specifically the large diffusion barrier of multiple-layer surface steps. Using a combination of atomistic simulations, we verify that this hypothesis is valid, and that the large diffusion barrier slows down surface diffusion by about a million times under typical processing conditions. Further, we formulate an analytical theory of nanorod diameter as a function of this diffusion barrier. Using physical vapor deposition experiments, we validate the theory and the concept of the new diffusion barrier. With the formulation of another analytical theory of nanorod separation, we establish a theoretical framework of nanorod diameter and separation as a function of processing conditions. This framework explains why metallic nanorods are nano, and has guided ensuing experiments to achieve the smallest metallic nanorods possible.

Abstract: Metallic Glue – a Nanotechnology

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Abstract:

This seminar presents a technology of metallic glue that connects solids without the need of high temperature and/or high pressure but is capable of functioning under high mechanical load and high temperature after setting. This technology (US Patent 10,646,964 B2) derives from the scientific discovery of small and well-separated metallic nanorods. Our scientific discovery starts with the physical origin of the nano scale of nanorod diameter. With theoretical formulations and experimental validations, we have established a theoretical framework of nanorod growth using physical vapor deposition. Guided by this theoretical framework, we have discovered the smallest and yet well-separated metallic nanorods using physical vapor deposition. Taking advantages of mechanical flexibility and fast surface diffusion of small nanorods, we have invented the technology of metallic glue. Our startup company MesoGlue Inc commercialize this technology and has further developed three other technologies along the same vein with lower cost (US Patent applications with allowance issued by USPTO in July 2023, 17/073,370, 17/365,757, and 17/365,811).

Abstract: Nanoelasticity and Nanoplasticity

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Abstract:

This seminar presents novel mechanisms of elastic and plastic deformations in nanomaterials. At the nanoscale, elastic constants are no longer constant and vary with the dimension of materials and deformation mode. Further, new plastic deformation mechanisms become operational. Using classical molecular dynamics simulations and density-functional-theory quantum mechanical calculations, we find that nanoscale elastic modulus can be larger or smaller than its bulk counterpart. Surface reconstruction, surface bond saturation, surface bond loss, and under-surface non-linearity compete to determine whether a nanomaterial is elastic stiffer or softer under a deformation mode. For plastic deformation, twin boundaries serve to increase the strength without the loss of plastic deformability, and dislocation glide on less-than-close-packed crystal planes takes place.