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A path to nano manufacturing: Science-based nanofabrication

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Manufacturing of nano scale devices or components in mass production relies on the control of atomic processes at the nano scale, in addition to engineering innovation. While novel nanostructures have been fabricated in research laboratories, their mass production at uniformity of structure and morphology remains a great challenge in general. To reach the mass production of nano manufacturing, the speaker suggests, science-based nanofabrication is the necessary starting point and a feasible path.

This presentation takes one-dimensional crystalline nano rods (or nano wires when their aspect ratio is large) from physical vapor deposition (PVD) as the prototype, to demonstrate the science-based nanofabrication. First, this presentation assesses the current status of PVD nano rods, to reveal the contrast of fancy realizations in experiments vs. little scientific understanding. Even at the very rudimental level, it should be known why nano rods are nano; that is, why is the diameter of nano rods on the nanometer scale. But this had not been the case. By going beyond and correcting the classical theory of surface step dynamics, a new framework emerges for nano rod growth. The second part of this presentation explains the concept of this framework, then the theoretical foundation with atomistic simulations for verification and experiments for validation. The third part of this presentation demonstrates how this framework enables science-based fabrication. This demonstration includes the experimental realization of well-separated and smallest metallic nanorods via PVD, both impossible without the scientific understanding as guidance. Finally, this presentation shows potential technological applications of the science-based nanofabrication, particularly in energy and military sectors.

Biography

Hanchen Huang is a Connecticut Clean Energy Fund Professor in Sustainable Energy at the University of Connecticut; he is also a recipient of Royal Society of London KTP Visiting Professorship, and an elected member of Connecticut Academy of Science and Engineering. He has taught at Rensselaer Polytechnic Institute and Hong Kong Polytechnic University, and has worked at Lawrence Livermore National Laboratory and China Institute of Atomic Energy. Hanchen Huang has delivered more than 100 invited/keynote/plenary lectures and seminars on the topics of nanofabrication and nano mechanics.

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