Stevens Institute of Technology

Nanotechnology Graduate Program

The Nano-World as a Manufacturing Playground: The Vision of Nanomanufacturing at NSF

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NSF Nanomanufacturing Program Director

Recent analytical explorations and insights into the nanoworld have afforded new opportunities and challenges in synthesis and manufacture of useful devices and systems to carry unprecedented functionalities to our macroworld. This lecture overviews the philosophy and background of our group in thermo-mechanical materials processing and manufacturing (fusion welding, material deposition, multi-layer coating, rapid prototyping, etc) modeling and control by scanned distributed-parameter, dynamic adaptive techniques. It also elaborates on current design and nanomanufacturing investigations in probabilistic branching tree-structured materials, such as: Nanocomposite layered foils by ultrasonic joining; Carbon-fiber polymer composites with nanoparticulates; Nano-heater sources by reactive material multi-layers; Ultrasonic and laser powder consolidation, net-shaping and metrology; Nanomaterial templating in anodized aluminum oxides; Fiber electrospinning for tissue engineering scaffolds and pharmaceutical vectors; and targeted drug delivery via magnetic micelle nanocapsules. The presentation also projects new research directions in multiscale design and manufacture of random fractal architectures; Extreme engineering of terrestrial and space structures; and Biomanufacturing of biomolecular machinery with the live cell as production plant. Research activities are coupled with related educational curricula, laboratory facility design and innovation activities, as well as outreach and administration initiatives through the Nanomanufacturing Program of the NSF.

Prof. Charalabos (Haris) Doumanidis holds his Diploma in Mechanical Engineering from the Aristotelian Univ. of Thessaloniki (1983), his M.S. from Northwestern University (1985), and his Ph.D. from MIT (1988). He has been a Professor of Mechanical Engineering and Director of the Hephaistos Thermal Manufacturing Laboratory at Tufts University (1991-2000); Chief Scientist with Axcelis Technologies (Thermal Processing Systems) in Beverly, MA (2000-01); Visiting Professor of Mechanical Engineering at MIT (2003-06); Professor (2003-present) and Marie Curie Chair (2004-2007), Founding Head of the Mechanical and Manufacturing Engineering Dept (2004-06) and Founding Director of the Hephaistos Nanotechnology Research Center at the University of Cyprus (2006-2009); the founding Director of the Nanomanufacturing Program at NSF; and consultant for the automation, optoelectronics, biomedical and automotive industry. He has been the speaker of over 20 keynote/plenary lectures and over 100 invited seminars; the author of over 200 refereed papers, eight patents and two book chapters. He is a recipient of the Marie Curie Chair of Excellence (2004) by the European Commission, the ASME Blackall Award (2002), the Presidential Faculty Fellow Award by the White House (1996), the NSF Young Investigator (1994) and Research Initiation Award (1992), as well as grants from NSF, SME, DoE, and NIST.

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