

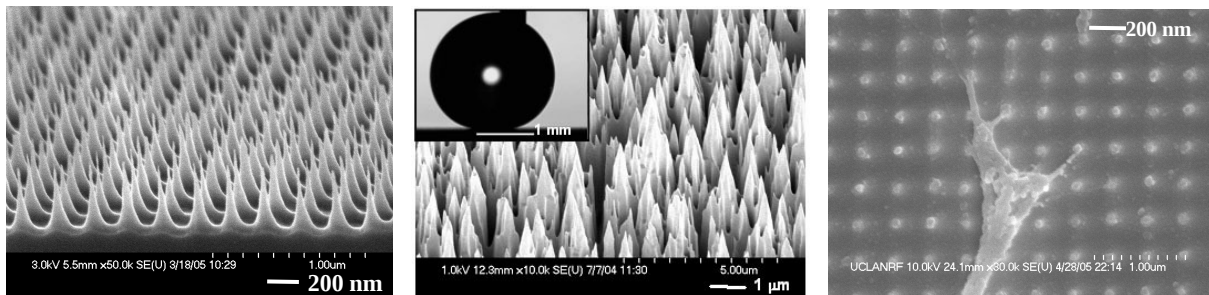
Multi-Functional 3D Nanostructures: Design, Fabrication, and Applications

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Nature such as plants, insects, and marine animals uses 3D micro- or nano-textured surfaces in their components (e.g., leaves, wings, eyes, legs, and skins) for multi-functional purposes such as self-cleaning, low-friction, antifouling, and anti-icing. As scientific quests and engineering applications reach down to such a nanometer scale, there is a strong need to fabricate three-dimensional (3D) nanostructures with good regularity and controllability of their pattern, size, and shape. In many applications, furthermore, the nanostructures are not useful unless they cover a relatively large area and the manufacturing cost is within an acceptable range. The first part of this presentation describes effective 3D nanopatterning and nanofabrication methods to create uniform nano-periodic structures of varying dimensions and shapes over a relatively large sample area by exploiting several different approaches. Such custom-designed 3D nanostructures over a large area with modulated sidewall profiles and tip sharpness can open new application possibilities in many areas. The rest of the talk presents a few examples of novel applications using the 3D nanostructures, especially to the hydrodynamic drag reduction in microfluidics and the nano-topographical cell adhesion control in tissue engineering. Future potential applications of 3D nanostructures to the other areas will also be discussed briefly.



Dr. Chang-Hwan Choi acquired his BS (1995) and MS (1997) in Mechanical & Aerospace Engineering from Seoul National University in Korea. He also earned his MS in Fluids, Thermal, and Chemical Processes from Brown University in 2002. Dr. Choi received his PhD in Mechanical Engineering from the University of California at Los Angeles (UCLA) in 2006, specializing in MEMS/Nanotechnology and minoring in Fluid Mechanics and Biomedical Engineering. He has two-year (1996, 2000) work experience at Korea Aerospace Research Institute and three-year (1997-1999) teaching experience at Chandrakasem Rajabhat University in Thailand. He has now been working as an Assistant Professor in the Department of Mechanical Engineering at the Stevens Institute of Technology since 2007. His current research activities include large-area nanopatterning and 3D nanofabrication, microfluidic self-assembly of nanomaterials, fluid physics and heat transfer at nanoscale interfaces, nanofluidic energy harvesting, and cell-material interactions, funded by NSF, DARPA, ONR, ARMY, and DOE. He has recently been named as a recipient of the 2010 Young Investigator Program (YIP) award by the Office of Naval Research (ONR) for his efforts in the development of 3D nanostructures for efficient anti-corrosion surfaces and highlighted in *Nature*, <http://www.nature.com/naturejobs/2010/100520/pdf/nj7296-385a.pdf>.