STEVENS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

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NanoTurf – A Nanoengineered Surface: Design, Fabrication, and Application to Microfluidics and Bioengineering

Chang-Hwan Choi
Department of Mechanical Engineering
University of California at Los Angeles

While several nano-scale patterning techniques are available, it should be noted that serial lithography methods (e.g., e-beam lithography and scanning probe lithography) do not cover a large area needed for non-electronic applications. Other non-lithographic methods, for example, the use of nano-templates (e.g., copolymers, nano-spheres, S-layer proteins, and a porous anodic alumina membrane) or the direct growth of nano-scale structures (e.g., carbon nanotubes) do not provide good regularity over a large area. Comparatively, interference (or holographic) lithography is a relatively simple way to make submicron-scale patterns over a large area with superior control of pattern regularity. We report a simple but effective method to fabricate high-aspect-ratio silicon nanostructures using interference lithography followed by deep reactive ion etching (DRIE). Sidewall profiles of nano-grating and nano-post patterns are controlled through etching parameters of DRIE. We also show that tips with a pointed and re-entrant profile can be created.

The proposed nanofabrication method to control the sidewall profiles and to sharpen the tips over a large pattern area opens new application possibilities not only in electronics but also in other engineering and general areas. As the first example, a large slip effect and the corresponding drag reduction of liquid flow by using the superhydrophobic nanostructures will be demonstrated. As the second, the control of cell behavior by using the three-dimensional nanotopography will be introduced, which is further envisioned to be utilized in tissue engineering.

Chang-Hwan Choi received his Bachelor of Science (1995) and Master of Science (1997) degrees in Aerospace Engineering from Seoul National University of Korea. Afterward, he worked as a lecturer at Chandrakasem Rajabhat University in Thailand for two years (1997-1999) and then as a researcher at Korea Aerospace Research Institute for one year (2000). After he acquired another Master of Science (2002) in Mechanical Engineering from Brown University, he has majored in MEMS/Nanotechnology in Mechanical Engineering at UCLA for the Ph.D. studies (2002-2006). Also minoring in Fluid Mechanics and Biomedical Engineering, his main research interest is the development of a novel nanofabrication technology and its application, in particular, to Microfluidics and Bioengineering.