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Patterning 3D Photonic Nanostructures using Light Scattering from Colloidal Particles

Abstract

“Bottom-up” self-assembly of nanoscale elements to form functional geometry is a well-established method in material science and a promising approach to nanofabrication. The assembled structures reflect the most energy favorable configuration and can be obtained without the expensive hardware that is commonly needed in “top-down” lithography systems. Recent research have explored using lithographic exposure as a way to increase the complexity of the self-assembled structures. I will discuss some of our efforts in harnessing light interactions with colloidal assemblies to design complex 3D nanostructures. By designing the relative length scale, periodic nanostructures with a wide range of unit-cell geometry can be patterned. This process is highly scalable and can be implemented in a roll-to-roll (R2R) fashion to allow continuous printing of periodic nanostructures. I will also discuss the scale-up challenges and photonic applications in nanolattice materials with near-unity index and their integration into optical multilayers.

Biography

Chih-Hao Chang’s research focuses on developing 2D/3D multifunctional nanostructures with novel physical properties and novel scalable nanomanufacturing techniques based on both “top-down” and “bottom-up” principles. Dr. Chang received his B.S. (2002) from Georgia Institute of Technology and his M.S. (2004) and Ph.D. (2008) from Massachusetts Institute of Technology (MIT), all in Mechanical Engineering. From 2011 to 2019, he was a faculty at the Mechanical and Aerospace Engineering at North Carolina State University (NCSU). Dr. Chang received the Early Career Faculty Award from National Aeronautics and Space Administration (NASA) in 2012, the Ralph E. Powe Junior Faculty Award from the Oak Ridge Associated Universities (ORAU) in 2013, and the Faculty Early Career Development (CAREER) Award from the National Science Foundation (NSF) in 2016. He also received the Outstanding Teacher Award from NCSU and the NC State Alumni Association in 2015, and was named a University Faculty Scholar by NCSU in 2016. Dr. Chang is currently an Associate Professor in the Walker Department of Mechanical Engineering at the University of Texas at Austin.