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Engineering material properties using block copolymer self assembly

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ABSTRACT

Block copolymer thin films provide a robust method for generating regular, uniform patterns at length scales in the range of ten nanometers, over arbitrarily large areas. A significant advantage of such block copolymer-based patterning is its ease of integration with all other aspects of traditional thin-film processing, including plasma-based etching and metallization. Because of the dearth of other high resolution, high-throughput patterning options, block copolymers are under intense scrutiny by the semiconductor electronics industry for lithography enhancement – an application with extreme demands on pattern uniformity. However, such process compatibility ensures a host of other application opportunities in designing material properties through control of their nanostructure. For example, we will describe our recent use of block copolymer self assembly in engineering broadband omnidirectional anti-reflecting surfaces for solar devices. Precisely controlling surface texture through block copolymer-based patterning can also render a material superhydrophobic, and able to remain water-repellent during droplet impacts at speeds in excess of 10 meters per second.

BIOGRAPHY

Dr. Charles Black is a Scientist and the Group Leader for Electronic Nanomaterials in the Center for Functional Nanomaterials, a US Department of Energy User Facility at Brookhaven National Laboratory. Dr. Black manages a group of 10 scientists exploring the use of nanostructures for solar energy conversion. Currently, Dr. Black's research interests include using nanostructured materials and self-assembly approaches in solar devices. From 1996 to 2006 Dr. Black was a Research Staff Member at the IBM Thomas J. Watson Research Center in Yorktown Heights, New York. His research program at IBM investigated using polymer self assembly for fabrication of high-performance semiconductor electronics. During his career Dr. Black has also performed experimental research in low-temperature scanning tunneling microscopy, single-electron tunneling devices, superconductivity in metal nanoparticles, nanocrystal-based electronic devices, and ferroelectric non-volatile memories. Dr. Black earned the Ph.D. degree in Physics from Harvard in 1996, and B.S. degrees in Physics and Mathematics from Vanderbilt in 1991. He has authored more than 80 scientific publications and conference proceedings, and four chapters of books. He currently holds 42 US Patents. Dr. Black is a Fellow of the American Physical Society and Senior Member of the IEEE.

EVENT DETAILS

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