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Silicon patterning using self-assembled PS-b-PAA diblock copolymer masks for anti-reflective black silicon fabrication via plasma etching XIN ZHANG, CHRISTOPHER J. METTING, SEAN FACKLER, ROBERT M. BRIBER, Department of Materials and Engineering, University of Maryland, College Park, MD 20742, USA, ANDREI B. SUSHKOV, H. DENNIS DREW, Department of Physics, University of Maryland, College Park, MD 20742, USA — The diblock copolymer of poly(styrene-b-acrylic acid) is a novel self-assembling mask material for pattern transfer applications. This material system has high dry etch selectivity and can produce a variety of feature types and size scales. Different vertical profiles were produced by altering the etch recipes and diblock copolymer or SiO2 mask processing. This patterning technique is used to fabricate antireflective silicon metamaterials that show broadband anti-reflection properties in the visible and infrared wavelength range (<5% total reflection). These materials are potentially useful for solar cell and light sensing applications. Similar surface roughening by chemical etch, porous silicon, nanowires and other methods have been used previously to reduce reflectance from material interfaces for photovoltaics and antireflection applications. Unlike these methods, the BCP self-assembled pattern transfer via RIE produces robust patterns that are tunable in both the horizontal and vertical directions without harsh chemicals or expensive catalysts. This simple and rapid process can also be applied to semiconductors other than silicon.

Xin Zhang
Department of Materials and Engineering,
University of Maryland, College Park, MD 20742, USA

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