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Influences of the Mie resonance on reflectance spectra of Si nanopillar arrays with different wetting states SUJUNG KIM, MINJI GWON, Ewha Womans University, JIAQI LI, imec, KU Leuven, XIUMEI XU, imec, SUNKYUNG KIM, Kyung Hee University, EUNSONGYI LEE, University of Manchester, DONG-WOOK KIM, Ewha Womans University, CHANG CHEN, imec, KU Leuven — The reflectance spectra of crystalline Si nanopillar (SiNP) arrays with various diameters were investigated by finite-difference time-domain (FDTD) simulations. The spectra exhibited distinct features depending on the wetting states. The FDTD-simulated reflectance dips of the 40-nm-diameter SiNP array were in good agreement with those estimated from destructive interference conditions at the top and bottom of the SiNPs: the SiNP arrays and the surrounding medium were treated as one optically homogeneous medium with an effective permittivity estimated from the effective medium approximation (EMA) model. However, the dip positions of the simulated spectra for 70-, 100-, and 130-nm-diameter SiNP arrays deviated from the results of interference calculations, particularly for short wavelengths. The optical reflectance spectra were significantly affected by the strong diameter-dependent Mie resonances in SiNPs, which were sensitive to the refractive index of the surrounding medium (i.e., the wetting state). Optical reflectance measurements provide an easy and efficient means of inspecting the wetting behavior of nano-patterned surfaces.

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