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Bragg Reflectors Based on Block Copolymer/ Polyhedral Oligomeric Silsesquioxanes (POSS) and TiO_2 Hybrid Nanocomposites[1]
CHENG LI, NICHOLAS COLELLA, JAMES WATKINS, Polymer Science & Engineering Umass Amherst — Maleamic acid functionalized polyhedral oligomeric silsesquioxanes (POSS) can interact with the poly (ethylene oxide) (PEO) block in Pluronics F108 block copolymer via hydrogen bonding to form well-ordered block copolymer nanocomposites. In this study, the block copolymer composites are spin coated into thin films and maleamic acid groups are thermal crosslinked to stabilize the nanocomposite structure. High temperature calcination of the stabilized nanocomposite yields a robust mesoporous silica thin film. By adjusting the loading of POSS into the block copolymer prior to calcination, the refractive index (RI) of mesoporous silica films can be tuned between 1.13 and 1.18. We show these low RI films can be sequentially layered with hybrid TiO_2 nanocomposite films that exhibit a RI of approximately 2.0 to yield efficient Bragg reflectors. The TiO2 films are prepared by the calcinations of polymer/anatase TiO2 nanoparticle composites with NP loadings as high as 90wt%. Due to the porosity existing in each layer, the wavelength of the reflected light is sensitive to the adsorption of solvent vapors such as toluene, isopropanol, and tetrahydrofuran, or analytes, which suggest applications in sensors.

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