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**Layer by Layer Fabrication of 3D Photonic Crystals by Substrate Conformal Imprint Lithography (SCIL) from Titania Nanoparticle Solutions** IRENE HOWELL, University of Massachusetts-Amherst, MARC VERSCHUUREN, Philips Research, ROHIT KOTHARI, JAMES WATKINS, University of Massachusetts-Amherst — We demonstrate a method for fabricating well-aligned, large-area, log-pile 3D photonic crystals. Using 15 nm titania (anatase) nanoparticles dispersed in a mixture of propanediol and methanol, we show that these nanoparticles can be patterned to produce robust, reproducible, 1  $\mu\text{m}$  pitch, 500 nm line-width gratings. By planarizing the grating with an organic UV-curable resin (Norland Optical Adhesive 60), subsequent titania layers can be patterned in the proper orientation, ending with a calcination step to remove the organic resin and create a 3D photonic crystal. This method allows for a photonic stop band in the infrared region, but the limitations in feature size and alignment capability prevent fabrications of a photonic crystal with a band gap at shorter wavelengths. By applying Substrate Conformal Imprint Lithography (SCIL) technology to this method, we can produce 3D photonic crystals with features suitable for a band gap in the visible region. SCIL utilizes a higher modulus PDMS (X-PDMS) to easily achieve sub-500 nm features. Additionally, the alignment method, involving box-in-box and Moire patterns, enables reproducible, precise alignment of sequential layers within 5 nm.

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