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High Refractive Index Poly(thiophene) for 3-D Organic Photonic Crystals MATTHEW GRAHAM, University of Akron, STEPHEN CHENG, University of Akron, SHI JIN, CUNY, Staten Island, TIMOTHY BUNNING, WPAFB Materials and Manufacturing Directorate — Traditional polymers have refractive indices too low to be used in high dimensional photonic crystals (PC). Poly(thiophene) (PT) is predicted to have a high enough refractive index to open a complete photonic band gap (PBG) in the commonly used inverse opal structure for 3-D PC, but experimental values have been significantly less than the prediction. To reconcile this discrepancy, the electro-polymerization of thiophene has been optimized with respect to reactant concentration, additives, and temperature. The resulting PT films had a significantly elevated refractive index, as measured by Variable Angle Spectrographic Ellipsometry, which was sufficient to open a complete PBG. The next step in fabricating an organic 3-D PC is to create high quality opal templates through which the PT could be polymerized. Colloidal crystallization of monodisperse polystyrene spheres was used to fabricate the templates, while a novel nano-mechnical annealing technique was used to perfect the crystal structure. Taken together these developments offer the opportunity to make a completely organic 3-D PC with a complete PBG.

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