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## Fabrication of Wafer-scale Polystyrene (2+1) Dimensional Photonic Crystal Multilayers Via the Layer-by-layer Scooping Transfer Technique

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We have developed a simple synthetic method for fabricating a wafer-scale colloidal crystal film of 2D crystals in a 1D stack based on a combination of two simple processes : the self-assembly of polystyrene (PS) nanospheres at the water-air interface and the layer-by-layer (LbL) scooping transfer technique. The main advantage of this approach is that it allows excellent control of the thickness (at a layer level) of the crystals and the formation of a vertical crack-free layer over a wafer-scale (4 inch). We investigate the optical and morphological properties of the PhC multilayers fabricated using various mono-sized colloidal crystals (250, 300, 350, 420, 580, 720, and 850 nm), and mixed binary colloidal crystals (300/350 and 250/350 nm).

**Keywords:** Polystyrene

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## Synthesis and Design of Electroactive Polymers for Improving Efficiency and Thermal Stability in Organic Photovoltaics

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Polymer based organic photovoltaics have attracted a great deal of attention due to the potential cost-effectiveness of light-weight and flexible solar cells. However, most BHJ polymer solar cells are not thermally stable as subsequent exposure to heat drives further development of the morphology towards a state of macrophase separation in the micrometer scale. Here we would like to show three different approaches for developing new electroactive polymers to improve the thermal stability of the BHJ solar cells, which is a critical problem for the commercialization of these solar cells. For one of the examples, we report a new series of functionalized polythiophene (PT-x) copolymers for use in solution processed organic photovoltaics (OPVs). PT-x copolymers were synthesized from two different monomers, where the ratio of the monomers was carefully controlled to achieve a UV photo-crosslinkable layer while leaving the  $\pi$ - $\pi$  stacking feature of conjugated polymers unchanged. The crosslinking stabilizes PT-x/PCBM blend morphology preventing the macro phase separation between two components, which lead to OPVs with remarkably enhanced thermal stability. The drastic improvement in thermal stabilities is further characterized by microscopy as well as grazing incidence X-ray scattering (GIXS). In the second part of talk, we will discuss the use of block copolymers as active materials for WOLEDs in which phosphorescent emitter isolation can be achieved. We have exploited the use of triarylamine (TPA) oxadiazole (OXA) diblock copolymers (TPA-b-OXA), which have been used as host materials due to their high triplet energy and charge-transport properties enabling a balance of holes and electrons. Organization of phosphorescent domains in TPA-b-OXA block copolymers is demonstrated to yield dual emission for white electroluminescence. Our approach minimizes energy transfer between two colored species by site isolation through morphology control, allowing higher loading concentration of red emitters with improved device performance. Furthermore, by varying the molecular weight of TPA-b-OXA and the ratio of blue to red emitters, we have investigated the effect of domain spacing on the electroluminescence spectrum and device performance.

**Keywords:** 고분자 태양전지, LED