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Tunable Photonic Band Gap Materials and Their Applications

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Photonic band gap (PBG) materials have been of great interest due to their potential applications in science and technology. Their applications can be further extended when PBG becomes tunable against various chemical and electrical stimuli. In recent, it was found that tunable photonic band gap materials can be achieved by incorporating stimuli-responsive smart gels into PBG materials. For example, the characteristic volume phase transition of gels in response to the various external stimuli including temperature, pH, ionic strength, solvent compositions and electric field were recently combined with the unique optical properties of photonic crystals to form unprecedented highly responsive optical components. Since these responsive photonic crystals are capable of reversibly converting chemical or electrical energy into characteristic optical signals, they have been considered as a good platform for label-free chemical or biological detection, actuators or optical switches as well as a model system for investigating gel swelling behavior. Herein, we report block copolymer photonic gels self-assembled from polystyrene-b-poly (2-vinyl pyridine) (PS-b-P2VP) block copolymers. In this talk, we are going to demonstrate that selective swelling of lamellar structure can be effectively utilized for fabricating PBG materials with extremely large tunability. Optical properties and their applications will be discussed.