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Control of Optical Hysteresis in Block Copolymer Photonic Gels: A Step Towards Wet Photonic Memory Films

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Smart gels have recently associated with photonic crystals to form photonic gels. Since these photonic gels are capable of reversibly converting the volume change of gels induced in response to external chemical or electric stimuli into characteristic optical signals, they have been considered not only as a good platform for label-free chemical or biological detection, actuators or optical switches but also as a good model system to investigate gel swelling behaviour. Recently, we reported block copolymer photonic gels self-assembled from polystyrene-b-poly(2-vinyl pyridine) (PS-b-P2VP) block copolymers, and demonstrated that selective swelling of lamellar structure allows extremely large tunability of the photonic stop band from UV region to IR region (λ peak=350～1,600 nm). Herein we report block copolymer photonic gels which exhibit strong tunable optical hysteresis and their applications. As nonlinear responses in swelling of hydrogels were often observed, photonic gels exhibit optical hysteresis with change of external pH. We demonstrate such optical hysteresis can be precisely programmed by controlling ion-pairing affinity. We anticipate that photonic gels with carefully tunned optical hysteresis are applicable to optical memory devices.