Illumination induced metastable polaron-supporting phase in poly p-phenylene-vinylene films

E. EHRENFREUND, E. GERSHMAN, Y. EICHEN, Technion-Israel Institute of Technology, T. DRORI, C.X. SHENG, Z.V. VARDENY, University of Utah — We found a new illumination induced metastable polaron-supporting phase in pristine films of a soluble derivative of poly-p-phenylene vinylene (MEH-PPV). In the pristine, un-illuminated MEH-PPV phase $A$, the polymer films do not show any long-lived photogenerated polarons. Prolonged UV illumination, however, was found to induce a reversible, metastable phase $B$, characterized by its ability to support the existence of abundant long-lived photogenerated polarons. In the dark, films of phase $B$ revert back to the original phase $A$ within about thirty minutes at room temperature. Relying on the well-established ubiquitous reversible photoinduced cyclization of diarylethenes into dihyrophenanthrene derivatives, we propose a reversible mechanism in which UV illumination creates metastable deep defects that substantially increase the photogenerated polaron lifetime.