259b Harnessing Light to Create Defect-Free, Hierarchically Structured Polymeric Materials

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Computer simulations reveal how photo-induced chemical reactions in polymeric mixtures can be exploited to create long-range order in materials whose features range from the sub-micron to the nanoscale. The process is initiated by shining a spatially uniform light on a photosensitive AB binary blend, which thereby undergoes both a reversible chemical reaction and phase separation. When a well-collimated, higher intensity light is rastered over the sample, the system forms defect-free, spatially periodic structures, which resemble the phases of microphase-separated diblock copolymers. If a non-reactive homopolymer C is added to the system, this component localizes in regions that are irradiated with a higher intensity light and one can effectively "write" a pattern of C onto the AB film. Rastering over the ternary blend with the collimated light now leads to hierarchically ordered patterns of A, B and C. The findings point to a facile, non-intrusive process for manufacturing high quality polymeric devices in a low-cost, efficient manner.