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Low Intensity Post Process Tuning of Optical Properties of Polymer-Plasmonic Nanoparticle Hybrids[1] CLARE MAHONEY, KYOUNG-WEON PARK, RICHARD VAIA, Wright Patterson Air Force Research Lab — The ability to fabricate flat optics with graded refractive indices through patterned plasmonic properties is attractive for compact photonics devices. Because simultaneous self-assembly of different nanostructures within a singular film is challenging, recent efforts have shifted towards post processing methods. For example, lasers coupled to surface plasmon resonances (SPR) can induce reshaping, but often times require intense power densities that damage the matrix. Herein, we demonstrate a lower temperature approach to nanostructure reshaping based on photo-thermal triggered local redox chemistry. Xe-lamp is shown to provide volume-conserved reshaping of gold nanrods (AuNRs) dispersed within polyvinyl alcohol . Within seconds, the aspect ratio can be reduced from 5.5 to 1 (>500 nm shift in the LSPR) while maintaining particle dispersion and alignment. Using the irradiation profile and matrix thermal diffusivity, gradient resolutions of 3 nm LSPR shift per micron are seen both spatially and through thickness. Furthermore, the polarization sensitivity of the LSPR enables polarization control in reshaping. Such scalable and energy efficient plasmonic post processes will be crucial to optical-nanocomposites into future technologies.

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