Nonlinear Refractive Index Dispersion of Polymers for Femtosecond Direct Laser Writing

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Direct laser writing (DLW) has been recognized as a unique technique for 3D prototyping with resolution beyond the diffraction limit. One trend in DLW technologies is the use of polymers given their favorable mechanical properties and optical quality, rendering them promising for the next generation of photonic devices. However, the increasing use of ultrashort pulse lasers makes refractive index dispersion a factor of basic importance in studying photonic materials. The extreme intensities involved in DLW processes raise the question of whether nonlinear dispersion is a limiting factor for candidate materials. Here, we provide the nonlinear refractive indices dispersion characterization of polymers commonly used in DLW technologies. We prepared resins obtained by photopolymerization and studied how different monomer compositions affect the refractive index in the visible and near-infrared range. We compared the nonlinear refractive indices thus obtained with reported values for fused silica, one of the most widely used photonic material, and we found values significantly higher for the polymers, demonstrating the potential of these materials.