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Saturation of Refractive Index Modulation in Photosensitive Materials. SERGIY MOKHOV, CREOL - the College of Optics and Photonics, Univ. of Central Florida — Photosensitive materials such as photo-thermo-refractive (PTR) glass are used in the fabrication of resonant reflective optical elements like volume Bragg gratings (VBG) for operation with high power laser beams. Fabrication process consists of initial UV expose with periodically modulated intensity formed in holographic recording setup and the following thermal development of a specimen converting imprinted expose pattern into refractive index modulation (RIM). Typical amplitude of RIM required for high reflectivity of narrow-band VBG is a couple of hundreds of ppm (part per million), and it is developed in the regime of linear photosensitivity of glass. At high expose dosage the photosensitivity saturates and refractive index change reaches a maximum value of approximately two thousands of ppm. Chirped Bragg gratings (CBG) with linearly varying modulation period are used for stretching/compression of short laser pulses with wide spectral range. In this case, the amplitude of RIM should be as large as possible since monochromatic spectral component reflects over short distance inside CBG. The amplitude of RIM at high dosages gains periodic profile significantly distorted from sinusoidal one due to saturability of photosensitivity. We derived analytical expressions for the efficient amplitude of RIM providing an actual resonant Bragg reflection for photosensitivity curves of hyperbolic and exponential shapes. These results are important for implementing proper holographic recording procedures since high dosages require long recording times and lead to side effects such as increased material absorption.

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