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"Physical Properties of Volume Holographic Recording utilizing Photo-initiated Polymerization for Nonvolatile Digital Data Storage", L. Paraschis, Y. Sugiyama, and L. Hesselink (Department of Applied Physics and Department of Electrical Engineering, Stanford University, Stanford, CA 94305)

ABSTRACT

The physical properties of photopolymer grating formation are, for the first time, investigated elaborately with respect to I, and Λ . The dynamics of holographic recording with constant exposure energy (15 mJ/cm^2), are evaluated for a wide range of different I (mW/cm^2 - W/cm^2), and for a few typical Λ (0.5 - 3.5 μm), in a material utilizing cationic ring opening polymerization (Polaroid CROP ULSH-500B). Diffusion was evaluated to limit the photo-initiated recording sensitivity at high I (> W/cm^2 ~ Λ^{-2}). At the same time, however, the significant post-exposure grating development observed for diffusion limited recordings, was identified to allow eventually for equally high sensitive final gratings (~3-5 cm/mJ) without reciprocity, or diffusion limitations. Based on these observations, a new physical model was developed that describes more accurately holographic recording utilizing photo-initiated polymerization, and accounts successfully for the observed physical properties of grating formation.