1.10 Photorefractive Effects in Organic Crystals and Polymers

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Due to their high sensitivity in the near infrared spectral range as well as their large second-order nonlinearities, organic materials are very promising candidates for nonlinear optical applications at wavelengths where commercially semi-conductor laser diodes are currently available. For these reasons, DAST and DANPH are suitable materials for photorefractive applications. Two-beam coupling experiments were performed on both materials. For DANPH, we could, for the first time to our knowledge, demonstrate a net gain in an organic crystal (Γ=0.85 cm^{-1} whereas α = 0.25 cm^{-1} at λ = 750 nm) for writing times of the order of hundreds of milliseconds at pumping intensities of 1W/cm^2. The first investigations performed on DAST showed a slightly lower net gain at the same wavelength for writing times of the order of seconds for the same writing intensities. Photoconductivity measurements, wavelength and electric field dependence of the photorefractive properties of these materials should lead to a better understanding of the physical mechanism responsible for the photorefractive effect in organic materials and especially crystals.

In the fast expanding field of so-called photorefractive polymers, we designed a new class of polymeric materials, namely polyamides based on DDANS. Photoconductivity in these materials was induced with the aid of photoconductors based on DEH. Doped polymers, polymer blends, random copolymers and block polymers were prepared to study the influence of the polymer morphology on photorefractive properties. We have so far investigated the processing of these polymers (spin-coating, solution casting), the poling procedure (using electrodes as well as Corona methods) and their physical properties (linear and nonlinear optical properties). Photoconductivity and two-beam coupling experiments (at different wavelengths, with and without applied electic field) are currently in progress.