2.7 A Comparison of Photoinduced Refractive Index Changes in Different Organic and Inorganic Materials

(G. Montemezzani)

During the past decade major advances were achieved in both theoretical and experimental aspects of photorefractive materials. The photorefractive effect has proved invaluable for demonstrating new techniques in industrial inspection, locking of laser diodes, image processing and holographic storage. The classical photorefractive materials such as inorganic electro-optic crystals and transparent ceramics are now challenged by new materials, i.e. organic crystals, photorefractive polymers and semiconductor multiple quantum well structures. At present, inorganic crystals are still the materials of choice for most applications. However a detailed comparison of the present performances indicates a rapid improvement of the new materials, which let us expect a strong competition in the next several years. Inorganic crystals have still a clear edge for typical ‘thick grating’ applications, such as holographic storage, optical phase-conjugation and laser beam cleanup. For ‘thin grating’ applications such as optical correlation and spatial light modulation, photorefractive polymers may become competitive with the best inorganic materials and semiconductor multiple quantum wells devices, provided a further improvement of their response speed is achieved. Preliminary experiments have shown that also a novel class of doped nematic liquid crystals can produce extremely large refractive index changes by a photorefractive-like real-time holographic process, thus showing promise as new low-power nonlinear optical materials.