Optical and chemical functionalities controlled at the micrometer scale in glassy materials by an imprinting thermo-electrical process.

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Abstract

We report on the ability of a thermal poling treatment to be considered as an imprinting process modifying linear and nonlinear optical properties as well as surface chemistry of glassy materials.
Concerning optical properties, the formation of gradient of refractive index (GRIN) with large variations (up to 5.10-2) have been optimized. The effectiveness of this imprinting process of GRIN has been demonstrated by forming matrices of micro-lenses (sizes from 5 to 100μm) on large area (several tens of centimeters square). [1] Using the same process, second order optical properties have been implemented in isotropic materials at the micrometer scale. Moreover, a geometry control of the electro-optical anisotropy induced has been demonstrated and controlled in periodic structure as shown by the fabrication of second harmonic generation gratings. [2] Such patterning of both linear and nonlinear optical responses can be obtained successfully on both oxide and chalcogenide glasses.

Finally, by combing specific structural rearrangements and charge implementations, we have demonstrated very strong and localized influence of the μ-poling treatment on surface reactivity, surface potential, and surface durability. [3-4]

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