



Effect of Replacement of As by Ge and Sb on the Photo-Response under Near Infrared Femtosecond Laser Irradiation in As-based Sulfide Glasses

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Auteur	J. Musgraves, David [1], Carlie, Nathan [2], Petit, Laetitia [3], Boudebs, Georges [4], Choi, Jiyeon [5], Richardson, Martin [6], Richardson, Kathleen [7]
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Résumé en anglais	<p>Bulk glasses having the compositions $\text{As}_{42}\text{S}_{58}$, $\text{As}_{36}\text{Sb}_6\text{S}_{58}$, and $\text{As}_{36}\text{Ge}_6\text{S}_{58}$ have been irradiated at 800 nm using a femtosecond-pulsed laser to determine the relationship between composition and photo-response. Localized variation in the glass volume (photo-expansion) has been determined through interferometric measurements of surface exposures, whereas induced refractive index change (photo-darkening) was determined from the diffraction efficiency of subsurface direct-written phase gratings. To understand the compositional dependence of the photo-response, the linear and nonlinear optical properties and structure of the unexposed glasses have been compared. The ablation threshold is shown to be controlled by variation of the nonlinear absorption, related to shifts of the absorption band gap with exchange of As by Ge or Sb. Changes in the unexposed network structure show that partial replacement of As by Ge or Sb induces an increased number of As-As bonding defects in the glass, particularly in the form of As_4S_4 molecular units which become polymerized into the network, impacting the photo-modification process. The Ge was found to induce an increase in the ablation threshold, and enhance both photo-darkening and photo-expansion effects, whereas Sb was shown to decrease ablation threshold and inhibit photo-darkening while enhancing photo-expansion.</p>
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