



**BILKENT UNIVERSITY**

**unam** - INSTITUTE of MATERIALS SCIENCE & NANOTECHNOLOGY

***FACULTY OF SCIENCE***

**MATERIALS SCIENCE and NANOTECHNOLOGY  
GRADUATE PROGRAM SEMINAR**

**“Nonlinear and Saturable Absorption Characteristics of Amorphous InSe, GaSe, 0.01 at% Ge doped GaSe and 0.5 at% Sn doped GaSe Thin Films”**

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We prepared very thin amorphous InSe, films and investigated the thickness dependence of the nonlinear absorption by pump-probe and open aperture Z-scan techniques. While thinner films (20 and 52 nm) exhibit saturable absorption, thicker films (70 and 104 nm) exhibit nonlinear absorption for 4 ns, 65 ps, and 44 fs pulse durations. This behavior is attributed to increasing localized defect states in the energy band gap as the film thickness increases. We developed a theoretical model incorporating one photon, two photon, and free carrier absorptions and their saturations to derive the transmission in the open aperture Z-scan experiment. The theory of open aperture Gaussian beam Z-scan based on the Adomian decomposition method was used to fit the experimental curves. Nonlinear absorption coefficients along with saturation intensity thresholds were extracted from fitting the experimental results for all pulse durations. The lowest saturation threshold was found about  $3 \times 10^{-3}$  GW/cm<sup>2</sup> for 20 nm film thickness with nanosecond pulse duration and increased about four orders of magnitude for 104 nm film thickness. By investigating undoped GaSe, 0.01 at% Ge doped GaSe and 0.5 at% Sn doped GaSe amorphous semiconductors it was found that saturation intensity threshold can be controlled not only by film thickness but also by doping. The lowest saturation intensity threshold for undoped GaSe film was about  $1.9 \times 10^{-3}$  GW/cm<sup>2</sup> for 45 nm film thickness and increased about two orders of magnitude for 74 nm film thickness.

**Date : April 2, 2010 (Friday)**

**Time : 15:40**

**Place : Faculty of Science Building, A Block, Seminar Room (SA 240)**

**Tea will be served after the seminar**