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Picosecond Time Resolved Beam Deflection and Reflectivity Study of Structural Relaxation in Ion Implanted a-Si

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Using an ultrafast optical pump and probe technique, we have studied the changes occurring in an ion implanted amorphous Si on sapphire film due to structural relaxation. Two different detection techniques, reflectance and beam deflection, have been adopted. Reflectance measurements performed over the picosecond to nanosecond time regime enabled quantitative investigation of the film thermal properties as well as the carrier recombination dynamics. The beam deflection measurements were used to detect acoustic generation in the film.

We have developed models to predict the reflectance variations and acoustic pulse profiles. Preliminary analysis of the reflectance data shows that structural relaxation leads to larger values of thermal diffusivity, optical absorption depth and recombination time. Beam deflection results show that structural relaxation induces broadening of the generated acoustic pulse, consistent with the model predictions.