

Investigation of Photo-induced Processes at Semiconducting Materials by Visible Pump - IR Probe Technique and Sum Frequency Generation Spectroscopy

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To fully understand the photo-induced processes at semiconducting materials, i.e., photocatalysis and photoelectrochemistry, it is essential to have information of each elemental processes such as carrier dynamics and dynamics of molecular structural change. In this work, we have employed visible pump - IR probe technique using fs laser (Fig. 1) and sum frequency generation spectroscopy using ps and fs (Fig. 3) lasers to obtain the former and the latter information.

Figure 2 shows transient IR (3600 cm^{-1}) absorption of CdSSe nano-clusters after the excitation by 600 nm light. Very fast decay corresponding to the hole dynamics is clearly observed. Effects of surface treatment and environments are now in progress.

Figure 4 shows SFG spectrum at TiO_2 surface which is in contact with ethanol vapor. Strong peaks corresponding to C-H vibration of methyl group were observed, showing the adsorption of ethanol on the surface. Effect of light illumination is now under investigation.

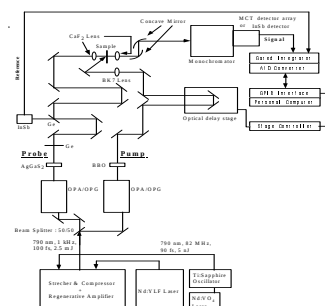


Figure 1 Schematic of the setup of the visible pump - mid-IR probe measurement system

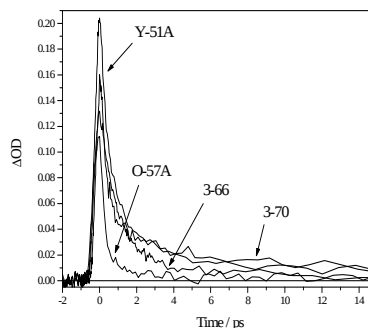


Figure 2 Temporal evolution of the absorption changes of $\text{CdS}_{1-x}\text{Se}_{1-x}$ -doped glasses

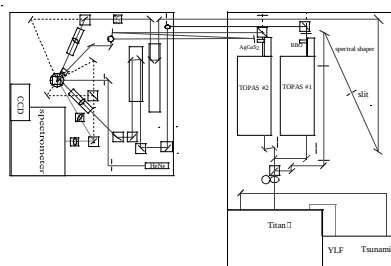


Fig. 3 Broad band SFG system.

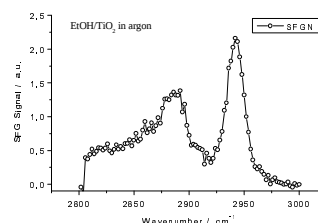


Fig. 4 SFG spectrum of TiO_2 surface in ethanol vapor.

