Determination of some characteristic parameters of CIGS thin films by optical measurements

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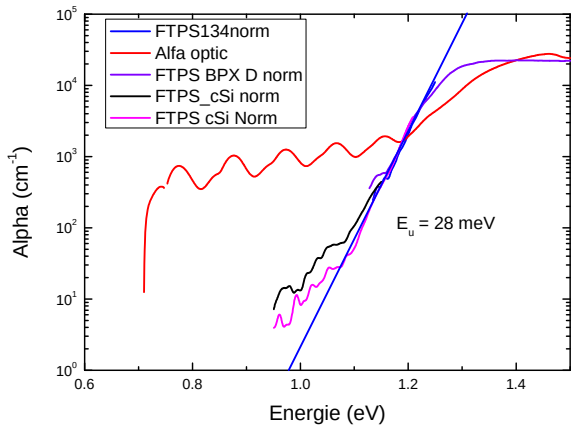
We have recently developed at Geeps an experiment to investigate on the absorption coefficient of thin film semiconductors. This experiment called Fourier Transform Photocurrent Spectroscopy (FTPS) allows measurements of variations over several orders of magnitude of the absorption coefficient α with the energy of photons impinging a thin film semiconductor. This experiment uses the properties of a Fourier Transform Infra Red (FTIR) spectrometer that delivers an interferogram of light. This interferogram generates carriers in the samples and, by means of an inverse Fourier transform of the resulting current, a spectrum can be derived that provides the answer of the sample. Using light with photons having an energy lower than the gap of the studied material, one can deduce variations of the absorption coefficient of the material with photon energy and subsequently deduce information on the density of states in its gap responsible for this absorption.

This experiment was successfully applied to hydrogenated amorphous silicon but its application to CIGS presents some difficulties because of the rather high level of dark current of such material. We have managed to achieve some measurements on CIGS layers and we shall present results on the absorption coefficient we measured.

Using the same set up, we have also developed experiments of transmission-reflection. From these measurements we have deduced the thickness of the film and its index. With some more sophisticated treatment we have estimated the value of α at the band edge, a value that was used to normalized the FTPS spectra. Finally, we have also estimated the mean size of the crystallites embedded in the film responsible for the dispersion of the light. The results on the mean crystallite size were confirmed by AFM.

All these results will be presented and discussed.



Variations de α avec l'énergie des photons mesurées dans différentes conditions ; alfa optic est déduit des mesures optiques ; FTPS BPX D de mesures avec une diode c-Si ; FTPS134 de mesures avec une diode InGaAs et un filtre optique à 746 nm ; les deux courbes FTPS_cSi avec un filtre optique en silicium cristallin et différentes conditions d'amplification du signal électrique.