Electrolyte Electroreflectance of Single-Crystal $CdIn_2Se_4$ in a Photoelectrochemical Solar Cell

Micha Tomkiewicz* and Withana Siripala

Department of Physics, Brooklyn College of CUNY, Brooklyn, New York 11210

ABSTRACT

Electroreflectance was used to evaluate the optical properties of $CdIn_2Se_4$ in polysulfide solution, before and after photoetching. The variations of signal intensity with electrode potential were used to trace the band position as a function of potential. It was found that the optical transition fits a three-dimensional parabolic model of the density of states, with direct transition at 1.825 eV. When the crystal is photoetched, there is a shift of 98° in the phase factor and a decrease in the broadening parameter from 0.42 to 0.32 eV. By monitoring the signal intensity with potential, it was shown that, irrespective of photoetching, the Fermi level is pinned as reverse bias conditions are approached. The pinning is ascribed to surface states that most likely originate from the adsorption of the electrolyte. The variation of the flatband potential with electrode potentials was calculated and was determined to occur because of the changes in the potential of the Helmholtz layer; the energy distribution and the density of states, which are responsible for those changes in potential of the Helmholtz layer, were also calculated.