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Use of p- type $CuAlO_2$ and NiO hole collectors in dye-sensitised solid-state solar cells

J P Yasomanee and J Bandara*
Institute of Fundamental Studies, Kandy

Oxide semiconductors with p-type conductivity were found to be good candidates to be used as hole collectors in dye sensitized solid-state solar cells (DSSC). Delofossite p-type $CuAlO_2$ semiconductor was synthesized by hydrothermal method and its activity on DSSC as a hole collector was studied. Energy positions of valence band (VB) and conduction band (CB) of $CuAlO_2$ were found to be suitable for it to be used as hole conductor in DSSC. Efficiency of the solar cells constructed with TiO_2/Ru dye/$CuAlO_2$ was about 0.04%. SEM images show that the particle size of $CuAlO_2$ prepared by hydrothermal method was larger than that of TiO_2. Therefore it penetrates weakly into the pores of TiO_2 nanocrystalline matrix resulting week interaction between dye and hole collector which was found to be one of the reasons for poor solar cell performance of solar cell constructed with $CuAlO_2$ as hole collector. Bigger particle size and poor p-type conductivity are found to be the major limiting factors of $CuAlO_2$ as a hole collector. Solar cell performances of electrodes constructed with TiO_2/Ru dye/NiO are also discussed.

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* jayasundera@yahoo.com Tel: 081-2232002