# Enhanced performance of $Sb_2S_3$ mesoscopic sensitized solar cells employing $TiO_2$:Nb compact layer

Abstract:

This paper reports on the enhancement of charge transport and recombination by niobium doped compact layers of $TiO_2$ in a solar cell with $Sb_2S_3$ absorber layer by characterizing both thin films of $TiO_2$:Nb and working solar cell devices with the layer stack FTO/cp-$TiO_2$:Nb/mp-$TiO_2$/$Sb_2S_3$/P3HT/$MoO_x$/Ag. The electron transport layers of $TiO_2$ doped with 0.14 and 0.27 at.% Nb were prepared by spin coating and have no structural change as determined from the analysis of GIXRD spectra. SEM images show thin pin hole free layers of the cp-$TiO_2$:Nb on FTO crystals that are agglomerates of particles. Analysis of the current–voltage curves of the solar cells with $Sb_2S_3$ as the absorber material showed increased short-circuit current, fill factor and power conversion efficiency from 1.3 to 1.7%. The enhancement of the device performance is attributed to substitution of Ti ions with Nb ions in the $TiO_2$ resulting in a change in the band alignment of the solar cells with Nb content. This results in increase in charge recombination resistance in the $Sb_2S_3$ layer as determined from the analysis of the impedance spectroscopy measurements.

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