Title: Fabrication of thin film solar cell materials by APCVD

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Abstract

Thin film solar cells are currently being implemented commercially as they reduce the amount of semiconductor material required for each cell when compared to silicon wafers, thereby lowering the cost of production. Currently two direct band gap chalcogenide thin-film technologies, CdTe and $CuInGa(S,Se)_2$ (CIGS), yield the highest reported power conversion efficiencies of 16.5% and 20.3%, respectively. In addition, Cu_2ZnSnS_4 (CZTS) is one of the most promising chalcogenide thin film photovoltaic absorber materials; with an optimal band gap of about 1.5 eV. More importantly, CZTS consists of abundant and non-toxic elements, so research on CZTS thin-film solar cells has been increasing significantly in recent years. Moreover, Sb_2S_3 based chalcogenide thin films have been proposed for use in photovoltaic applications.

The preparation of chalcogenide thin films solar cells commonly use physical vapour deposition methods including thermal/e-beam evaporation, sputtering, and pulsed laser deposition, electrochemical deposition, spray pyrolysis, solution-based synthesis, followed by the sulfurization or selenization annealing process. In this paper, we report a non-vacuum process, using atmospheric pressure chemical vapour deposition (APCVD), to fabricate chalcogenide thin film solar cell materials as well as transparent conductive oxide (TCO) thin films. The optical, electrical, and structural properties of these materials were characterized by UV-VIS-NIR, four-point probes, SEM, EDX, XRD, Micro-Raman.

Biography

Dr Kevin Chung-Che HUANG obtained his PhD in optoelectronics at the Optoelectronics Research Centre (ORC), University of Southampton in 2005. He has been working on chalcogenide and emerging materials fabricated by means of chemical vapour deposition (CVD) since his PhD study at the ORC in 2001. He has published 33 refereed papers and conference publications and is the holder for the patent of germanium sulphide based materials fabricated by CVD. Currently, he is a Senior Research Fellow at the ORC and has been in charge of the CVD project for the investigation of chalcogenide and novel materials for photonic devices, phase-change memory, and thin-film solar cell applications.