Electrostatic Deposition of Thin Film Solar Cells

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Abstract

During the last two decades there have been extensive studies to manufacture inexpensive solar cells with high conversion efficiency for commercial applications. Thin film solar cell technology minimizes material costs and environmental pollution associated with the manufacturing process of conventional single-crystal Si solar panels. Electrostatic deposition of hetero-junction n-type CdS film (2.42 eV bandgap) in contact with p-type CdTe (1.5 eV bandgap) film is one of the emerging processes for manufacturing cost effective polycrystalline solar panels. The CdS/CdTe hetero-junction film structure is sandwiched between a metal film at the bottom which is in ohmic contact with the CdTe film (thickness 5 μm) and a transparent conducting oxide (TCO) buffer layer of 100 nm thickness covering the CdS film (thickness 100 to 400 nm). The film structures are supported by an anti-reflection coated glass substrate at the top which faces the incoming solar radiation. We discuss here the methods of electrostatic deposition of CdS, CdTe, and the TCO films for producing solar cells. The electrostatically deposited films are annealed at a controlled temperature to develop crystalline structures. The microstructural characteristics of the films and their optical absorption properties are reported. Electrostatic deposition method provides a means of large scale production of p-n junction solar cells without using high vacuum equipment. Other advantages and disadvantages and its potential application in the billion dollar photovoltaic industries are briefly discussed.