DEPOSITION OF Bi_2S_3-Sb_2S_3 THIN FILMS VIA CLOSE-SPACED SUBLIMATION

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The emergence of new PV applications in the society requires the design of materials and devices with a different set of properties. At this scale, for a new photovoltaic (PV) technology is not sufficient to be only competitive with the Si and CdTe technologies in efficiency and reliability but one should also rely on green, environmentally friendly, and earth-abundant materials. An emerging class of highly promising PV materials currently under widespread investigation in the PV community are the inorganic antimony-and bismuth-based chalcogenide compounds. The excellent intrinsic material properties of these compounds allowed to rapidly approach 8-10% conversion efficiency, opening a new chapter in PV research, full of new possibilities but also scientific challenges.

This poster depicts our preliminary results of the employing of close-spaced sublimation (CSS) technique to deposit Bi_2S_3-Sb_2S_3 alloys as thin films. To get an alloy, Bi_2S_3 and Sb_2S_3 powders were grinded, mixed, and heated in tubular furnace at 800 °C for 24 hours. Five ratios of Bi_2S_3 and Sb_2S_3 were tested – 10%, 33%, 50%, 67%, 90% of Sb_2S_3 in Bi_2S_3. Then, resulting ingots were crushed into powder and used as a source material for CSS thin-film deposition. Alloys needed different deposition regimes (temperature, time) to be deposited in a form of even film with controllable thickness. Bi_2S_3-rich alloys required lower temperature difference and longer deposition procedures, compared with Sb_2S_3-rich alloys.

Resulting films were characterized using X-ray diffractometry, Hall measurement, UV-Vis spectroscopy, scanning electron microscopy and energy-dispersive X-ray spectroscopy. Also, thin-film solar cells were made, by CSS-deposition of alloys atop of buffer layers (CdS, TiO_2 and Bi_2O_3). FTO and gold were used as front and back contact respectively. The electric properties of resulting solar cells were characterized by J-V measurement.

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