A plasma-enhanced close-spacing sublimation (PECSS) device for photovoltaic thin-film modification

GARRETT METZ, Colorado State University - Department of Mechanical Engineering, LEN MAHONEY, Colorado State University Faculty Affiliate, JOHN WILLIAMS, DREW SWANSON, WALAJABAD SAMPATH, Colorado State University - Department of Mechanical Engineering — A plasma-enhanced, close-spacing sublimation (PECSS) device has been developed for improving CdS deposition on a transparent conductive oxide (TCO)-coated substrate that is part of the plasma production circuit. This unique device and process method makes possible the elimination of pin holes in the CdS transmission layer. In addition the process has been used to incorporate oxygen-dopants within the CdS layer, reducing absorption, and thereby increasing cell efficiency. We review the spatial uniformity of the ion current flux on the TCO-coated substrate when operating with Ar/O$_2$ and N$_2$/O$_2$ by means of in situ surface probes fashioned by laser-scribing strips in the TCO coating. Bulk plasma features of the PECSS device are also reviewed including electron energy and plasma potential. Process utility, modeling, and scaling of the PECSS device are reviewed for pressures of 40-200 mTorr and surface areas of 60 – 1700 cm$^2$.

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