THIN-FILM PHOTOVOLTAICS

Signs of aging

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Copper indium gallium diselenide or disulfoselenide (CIGS) solar cells are a mainstream, efficient and stable photovoltaic technology, with power conversion efficiencies up to 23.35%. One of the factors limiting their market share is the manufacturing cost, which can be reduced by optimizing the processing of the functional layers in the device. For instance, solution growth steps used for depositing the buffer layer in state-of-the-art CIGS devices can be replaced by dry methods that can be easily integrated into in-line production. Now, Jakapan Chantana, Takashi Minemoto and colleagues at Ritsumeikan University, the Tokyo Institute of Technology and Idemitsu Kosan Co., Ltd. in Japan show how the formation of a native buffer layer upon oxidation of the CIGS absorber enables efficiencies up to 22% in all-dry processed devices.

The researchers monitored the photovoltaic performance of CIGS films kept at a low partial pressure of oxygen at room temperature for several months. Starting from efficiencies below 5%, after a 10 month aging period, the CIGS film delivers up to 22% efficiency following a marked improvement in the external quantum efficiency and, hence, the photo-generated current. The researchers propose that oxygen reacts with indium and sulphur, forming a mixed oxide–sulphide layer at the top surface of the CIGS absorber. This layer improves charge separation and acts as a hole-blocking barrier while also protecting the absorber from damage caused by the deposition of subsequent layers. To be implemented in industrial manufacturing, the researchers suggest that the process can be accelerated by annealing the CIGS films under a partial pressure of oxygen.

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