Roll-to-roll fabrication of solar cells through process and chemistry engineering

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Abstract

Research within Perovskite solar cells (PSC), taking the advantage of an organic-inorganic charge generator thin film, has recently garnered a great interest due to its swift efficiency improvement, being cost effective and full fabrication feasibility through roll to roll automated processes. Successful fabrication of PSC with high performance necessitates the formation of uniform thin films with superior morphology. We have found that the addition of chemistries and implementation of a rapid processing has resulted in high efficiency solar cells at potentially high throughputs. The addition of diiodomethane to the perovskite absorber enhances efficiency through minimization of defect states and charge recombination within the perovskite film by retarding the crystallization and releasing excess iodine ions during the annealing processes. The chemistry also enables the use of a rapid processing technique, intense pulsed light (IPL), induces thermal and chemical responses upon the absorption of pulses of light. Our experimental results demonstrated a 65% performance improvement resulting in 16.5% efficiency when rapidly annealed through ultrashort duration pulses from a Xenon lamp in the air with relative humidity of 50%. Obtaining such high efficiencies can pave the way towards commercialization of PSC through rapid and cost-effective manufacturing of efficient PSC through roll to roll.

Biography of Presenter

Amir H. Ghahremani is a PhD candidate in the Mechanical engineering department at the University of Louisville. His research is focused on the development of thin films and scalable techniques pertinent to roll to roll manufacturing of efficient and cost effective organic-inorganic Perovskite solar cells. These methods include the application of ultrasonic spray, slot die and inkjet printing along with the use of intense pulse light for high throughput annealing.