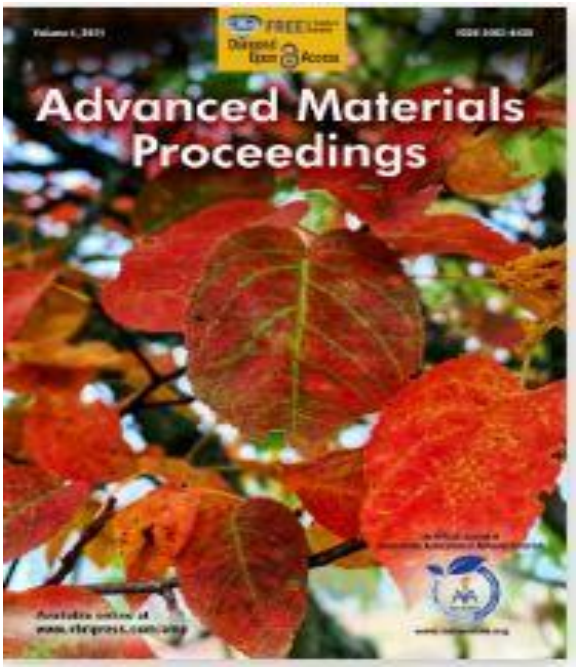
Degradation analysis of organic solar cells under variable conditions

Authors
Vinamrita Singh Vishal Sharma Swati Arora Manoj Arora R. P. Tandon*

10.5185/amp.2016/113

Abstract
In the present work, the degradation mechanism of ITO/PEDOT:PSS/P3HT:PCBM/Al solar cells has been studied under variable environmental conditions, i.e., in air and under vacuum. It was observed that the absorption for P3HT:PCBM film kept under normal atmospheric conditions decreased slightly after 350 hours of fabrication. When these films were kept under vacuum, no change in the absorption intensity was observed. However, when the P3HT:PCBM films with PEDOT:PSS layer were studied, an increase in absorption spectra was observed both under air and vacuum. This strongly suggests that the presence of hygroscopic PEDOT:PSS adversely affects the optical properties of thin films and hence the solar cells. The AFM images of the films after degradation showed presence of microscopic holes and mico-sized particles. The decrease in mobilities with time was also less when the devices were kept in vacuum. This suggests that the decrease in mobility is dependent on the decreasing crystallinity of P3HT:PCBM films as observed by XRD data and due to diffusion of impurities. The fall in efficiency of fabricated devices is higher for device exposed to the environment as compared to the fall for device kept under vacuum. These analyses give insight into the possible degradation pathways and help in eradicating the factors responsible for short shelf-life of organic solar cells, thus enabling better device performance in future.

Keywords
Organic solar cells degradation charge carrier mobility density of states interface



Indexing and Abstracting

Publons

ROAD