Contribution ID: **259** Type: **Oral Presentation**

Enhancing light absorption and life-time stability of organic solar cells using pentacene encapsulation.

Thursday, 2 July 2015 10:00 (20 minutes)

Abstract content
   (Max 300 words)
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Polymer solar cells continue to be investigated as a potentially cheap and viable photovoltaic alternative to the increased global demand for inexhaustible, clean and affordable energy. The most promising designs are based on a bulk heterojunction concept based on combination of electron-donating and electron-accepting molecular materials. However their low power conversion efficiency and stability over lifetime preclude their commercialization. In this work, the effect of surface Plasmon resonance on photo-conversion efficiency and life stability are investigated. Ag surface plasmons synthesized by RF magnetron have been characterized for optical absorption changes upon annealing. The annealed plasmons were grown on ITO before spin coating hole transport layer (PEDO:PSS) followed by P3HT:PCBM blend before thermally evaporating Al electrode. Incorporation of surface plasmons into a polymer based photovoltaic device as a proof of concept enhanced the photo-conversion efficiency by 24%. In addition, Ag plasmons encapsulated by pentacene has been investigated for multiple light absorption and charge transport using I-V characteristics and optical spectroscopy. This was done by thermally evaporating thin film of pentacene in an attempt stabilize the Ag plasmons. Besides production of multiple absorption peaks, the encapsulation has enhanced the device lifetime. We thus establish the potential degradation mechanism in detail using I-V characteristics under light illumination 70W/cm2.

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Session Classification: Applied

Track Classification: Track F - Applied Physics