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器件制备及器件物理

溶剂预处理结合热退火提升聚噻吩结晶度及其光伏性能

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摘要： 活性层的微观形貌在很大程度上决定了聚合物光伏器件的性能表现并依赖于制备工艺条件。为了改善薄膜内部分子排布结构并追求较高的器件光电转化效率，采用溶液法制备了基于P3HT：PCBM的聚合物太阳能电池（器件结构:ITO/PEDOT：PSS/P3HT：PCBM/Al），通过改变器件制备流程中活性层退火处理工艺，研究了热退火、溶剂退火以及溶剂预处理结合热处理的双重退火对聚合物太阳电池性能的影响。研究发现:双重退火的光伏器件的各项性能参数均优于单一退火处理器件，获得了3.25%的光电转化效率。原子力显微镜及X射线衍射仪的表征结果进一步证明:双重退火处理能够在促进聚合物给体良好有序结晶的同时保证共混组分适度地相分离，从而有利于光生激子的解离以及载流子的传输。

关键词： 溶剂退火 热退火 聚合物太阳能电池

Improvement of Polymer Crystallinity in Poly(3-hexylthiophene)-based Solar Cells *via* Solvent Vapor Pretreatment-assisted Thermal Annealing

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Abstract: The performances of polymer solar cells (PSCs) depend on processing conditions strongly. In order to increase the crystalline content of polymer and therefore improve the photovoltaic performance of devices, a combinative annealing process featured toluene vapor pretreatment and thermal annealing was introduced to the organic photovoltaic device fabrication, resulting in a high PCE up to 3.25% for P3HT： PCBM-based solar cells. The results of XRD and AFM further revealed that the improvement of J_{SC}, V_{OC} and *FF* were attributed to the improved P3HT crystallinity and chain ordering which facilitated photogenerated exciton dissociation and charge-carrier transport, compared with solvent or thermal annealed samples.

Keywords: solvent vapor annealing thermal annealing polymer solar cells

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