

On the importance of morphology in donor-acceptor composite organic solar cells

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Low-cost photovoltaic cells, which are light and flexible, could open up many new applications for solar cells, from self-powered electronic newspapers to self sufficient buildings. Among the various thin film techniques, solution processed organic solar cells have the highest potential for a true low cost technology since production requires only low temperature solution coating with low resolution. Such photovoltaic elements based on donor acceptor composites, being manufactured by printing and coating techniques from reel to reel, are not only scientifically interesting but highly attractive from a cost standpoint. One of the most critical issues to ensure efficient charge separation is the optimization of the interface between donor and acceptor phases, that is, the nanostructure of the composite film. By mixing the two components, an interpenetrating network of donor and acceptor materials is created inducing a 3 dimensional “bulk” interface photovoltaic cells. Morphology studies of these active blends revealed that the solvent used to prepare them plays a critical role for the quality of the “bulk heterojunction”. But several other approaches have recently been employed to enhance the structure of the composite and control its nanoscopic arrangement. Although the absorption of the conjugated polymers available now do not perfectly fit the solar emission spectrum, efficiencies higher than 6 % have been reported, paving the way to the production of low-cost, flexible, light-weight solar cells.