

Relationships between photoactive layer film morphology of hybrid polymer solar cells and nanoparticle dispersion colloid stability

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Abstract

Hybrid polymer solar cells, containing a blend of inorganic nanoparticles and conjugated polymers, possess significant potential for low cost, emission-free power generation. Extensive aggregation of the nanoparticles occurs in the photoactive layers of hybrid polymer solar cells. This results in polymer domains that are large compared to the exciton diffusion length and favours recombination. Uncontrolled nanoparticle aggregation reduces the maximum power conversion efficiencies that could be achieved.¹ Solar cells of ZnO nanoparticles within a hole transporting polymer phase have recently been reported². In this system the optimum dispersion stability of the ZnO nanoparticles and the best morphology of the deposited films is found when a co-solvent blend is used that contains 10 % methanol and 90% chloroform. In this work we present the results of our investigations into the factors controlling dispersion stability of ZnO nanoparticle / poly(triarylamine) / co-solvent dispersions and show how these influence photoactive layer morphology. It is suggested that an understanding of the parameters that control colloidal dispersion stability during film formation could lead to a significant enhancement in the power conversion efficiencies of hybrid polymer solar cells.

References:

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