

## CONJUGATED BLOCK COPOLYMERS FOR PHOTOVOLTAICS

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### ABSTRACT

Polymer or ‘plastic’ thin film solar cells have great potential to offer large scale and cost effective solutions for clean and renewable solar energy conversions. However, compared to inorganic photovoltaics, the power conversion efficiencies of current polymer based solar cells are still relatively small due to at least three severe losses, namely the ‘photon loss’, the ‘exciton loss’ and ‘carrier loss’ [1-2]. To minimize those losses, organic or polymeric materials must be optimized in both spatial and energetic regimes. In energy regime, for instance, the photon and carrier losses could be minimized by tuning the frontier orbital levels of both donors and acceptors. To minimize exciton and carrier transport losses, optimizations at spatial regime must be done. Spatial optimization mainly involves controlling the donor and acceptor phase size to be within the average exciton diffusion length of photo induced exciton. Also, both electrons and holes need their own uninterrupted transport pathways toward the respective electrodes. That is why a Bicontinuous Ordered Nano Structures (BONS) are most desired. In order to achieve BONS, a series of -DBAB- and DBA type block copolymers and their ‘tertiary’ supra-molecular nano structures (where D is a conjugated donor block, A is a conjugated acceptor block, and B is a non conjugated and flexible bridge chain) have been designed, synthesized, characterized, and preliminarily examined for photovoltaic applications. For instance, in comparison to a corresponding donor/acceptor (D/A) simple blend, the -DBAB- type block copolymer exhibited much better photovoltaic performances ( $V_{oc}$  increased from 0.14 volt to 1.10 volt, and  $J_{sc}$  increased from 0.017 mA/cm<sup>2</sup> to 0.058 mA/cm<sup>2</sup>) [3-4].

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