Segmented Polymer Donors for Application in Organic Photovoltaic Bulk Heterojunctions

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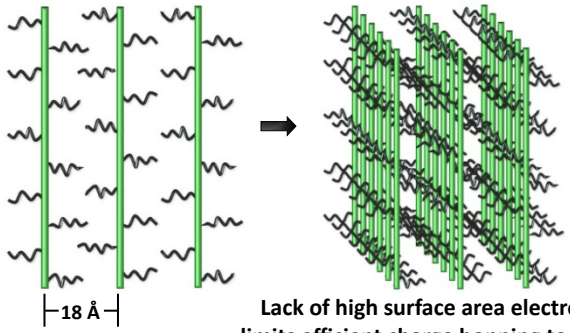
The most frequently exploited method of enhancing conjugated polymer solubility, for bulk heterojunction (BHJ) solution processing, is to attach either long-chain or branched alkyl substituents to rigid-rod polymer backbones. An important caveat of this strategy, however, is the sacrifice of efficient charge transport for processability. Upon crystallization, the rigid-rod macromolecules tend to assemble into lamellar sheets separated from one another by the lengths of their interdigitated alkyl chains (Fig 1). The hopping mechanisms governing charge transport are therein placed out of reasonable reach, limiting charge carrier mobilities and increasing exciton recombination.

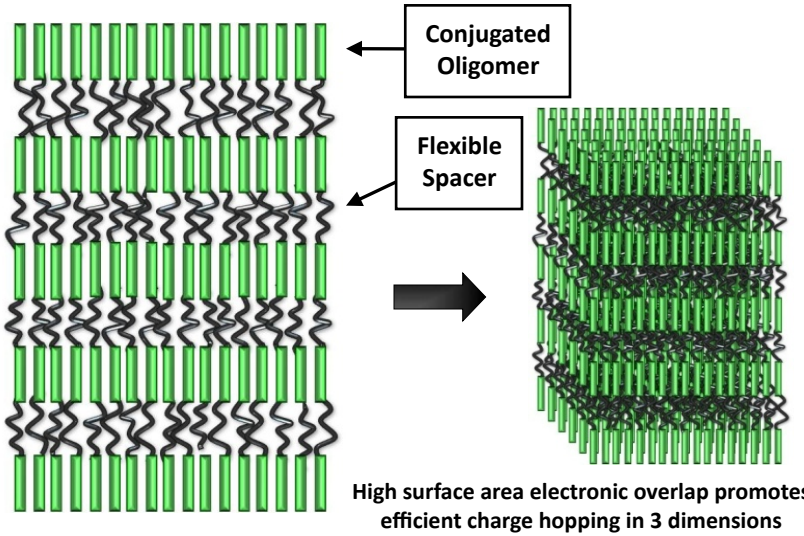
A modified approach to the location of solubilizing groups is needed to improve upon the solar power conversion efficiency of contemporary BHJs. The intent of this work to explore an alternative design based on segmented polymers. It is anticipated that the microstructure of these polymers will lead to bulk morphologies which are better adapted to facilitate charge transport in BHJs (Fig 2).

Figure 1. Representation of bulk morphology assumed by rigid-rod polymers



Lack of high surface area electronic overlap limits efficient charge hopping to 2 dimensions

Figure 2. Representation of bulk morphology assumed by proposed segmented polymers



High surface area electronic overlap promotes efficient charge hopping in 3 dimensions

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