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Title

Charge Mobilities in Conjugated Polymers Measured by Pulse Radiolysis Time-Resolved Microwave Conductivity: From Single Chains to Solids

Source

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Abstract

We discuss how the mobility of a charge moving along a conjugated polymer chain is affected by different types of disorder. The intrachain mobility has been determined by using pulse radiolysis in combination with microwave conductivity measurements. The intrachain mobility of charges on isolated planar ladder-type poly(p-phenylene) chains in solution is as high as 600 cm(2)/(V s). In solid samples, the intrachain mobility is only 30 cm(2)/(V s) due to disorder caused by interactions between different polymer chains. Interestingly, this mobility is 4 orders of magnitude higher than the DC device mobility, which is limited by charge hoping between different chains. Torsional disorder along poly(p-phenylene vinylene) chains limits the intrachain mobility to 60 cm(2)/(V s), while in polyfluorenes, coiling of the chains strongly reduces the mobility. The results imply that higher charge mobilities can be realized in devices if the polymer chains directly interconnect the electrodes and adopt a straight, planar structure in a homogeneous environment.