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Title:Origin of low sensitizing efficiency of quantum dots in organic solar cells
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Abstract:Organic semiconductors are of great interest for application in cheap and flexible solar cells. They have a typical absorption onset in the visible. Infrared light can be harvested by use of lead-chalcogenide quantum dot sensitizers. However, bulk-heterojunction solar cells with quantum-dot sensitizers are inefficient. Here we use ultrafast transient absorption and time-domain terahertz spectroscopy to show that charge localization on the quantum dot leads to enhanced coulomb attraction of its counter charge in the organic semiconductor. This localization-enhanced coulomb attraction is the fundamental cause of the poor efficiency of these photovoltaic architectures. It is of prime importance for improving solar cell efficiency to directly photogenerate spatially separated charges. This can be achieved when both charges are delocalized. Our findings provide a rationalization in the development of photovoltaic architectures that exploit quantum dots to harvest the near-infrared part of the solar spectrum more efficiently. © 2012 American Chemical Society.
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