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On the Assembly of Functionalized CdSe Nanorods

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Abstract
High aspect ratio (AR) CdSe nanorods (NRs) of well-defined sizes were synthesized to optimize the geometries of photovoltaic devices made from these nanorods. Long-range ordering of hexagonal arrays of high AR NRs is achieved by a combination of controlled solvent evaporation and the use of an applied electric field. Regioregular P3HT chains and oligothiophene were functionalized with ligating end-groups to provide contact to the NRs. Vertically oriented assemblies of CdSe NRs functionalized with terthiophene and polythiophene are also obtained. Hexagonal arrays of these nanocomposites were characterized by transmission electron microscopy (TEM). Three types of polythiophenes:

poly(3-hexylthiol thiophene), poly(3-hexylamine thiophene), and poly(3-hexylphosphonate thiophene) with thiol, amine, and phosphonate functional groups, were synthesized to anchor to the NRs. This led to a thin layer of p-type conducting polymer covering tips of the n-type inorganic NRs forming end-to-end assembly. Ternary nanocomposites of CdSe-polythiophene-graphene were obtained *via* π- π stacking. These oriented CdSe NRs-polythiophenes nanocomposites have potential applications in organic-inorganic hybrid bulk heterojunction photovoltaic devices.