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Directed assembly of core-shell hybrid nanomaterials for polymer photovoltaics[1] SHANJU ZHANG, CANDICE PELLIGRA, LISA PFEFFERLE, CHINEDUM OSUJI — The creation of large-area aligned nanohybrid films/arrays remains a challenge in the fabrication of ordered heterojunction photovoltaics. We demonstrate a bottom-up approach based on the directed assembly of lyotropic inorganic-organic core-shell nanohybrids. Semiconductor nanowires are prepared by solvothermal synthesis. Diameter and length of the nanowires are controlled by various reaction parameters. Core-shell nanohybrids are prepared by grafting conjugated polymers onto the nanowires. Effect of the nanowire diameter on the polymer coating is demonstrated. We show that high aspect ratio nanohybrids spontaneously form nematic phases in liquid media. These systems show isotropic, bi-phasic and nematic phases on increasing concentration in reasonable agreement with Onsager's theory for rigid rods. Suspensions are readily processed to produce films with large-area monodomains. With a decrease of nanowire diameter, the polymers in the nanohybrids tend to form ordered crystalline layers, in which the conjugated backbone is aligned along the nanowire long axis. The corresponding optoelectronic properties are discussed.

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