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Polymer mediated solution self-assembly of nanorods

MIGUEL A. MODESTINO, RACHEL A. SEGALMAN, University of California, Berkeley — Control over the self-assembly of nanorods in polymer composites enables the design of hybrid materials in which the anisotropic properties of the nanocrystals can be harnessed efficiently. Here, we demonstrate that a delicate balance between entropic and enthalpic interactions controls the self-assembly behavior of nanorods in solutions and can lead to the formation of ordered nanorod arrays. Small angle X-ray scattering techniques were used to elucidate the phase behavior of CdSe nanorods in polymer solutions and to identify the concentration space that allows for the formation of nanorod superlattices. Furthermore, this work demonstrates that enthalpic interactions have strong effects on the nanorod self-assembly, and that the presence of reversible thermal transitions can allow for the growth of large nanorod arrays. The solution self-assembly behavior discussed in this study allows for the fabrication of solution processable composite thin films with vertically aligned nanorods over large areas.

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