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Direct Nanoscopic Imaging of Mesophase Formation from Anisotropic Nanoparticles ZIHAO OU, Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign, ZIWEI WANG, ERIK LUIJTEN, Department of Materials Science and Engineering, Northwestern University, QIAN CHEN, Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign — We utilize the emergent nanoscopic imaging technique, liquid phase transmission electron microscopy, to suggest a paradigm shift from imaging the dynamics and transformations of micron-sized systems to nanoscale objects in liquids. Here highly anisotropic nanoparticles are used as a prototypical system and are observed to assemble into a non-trivial mesophase, a plastic crystal with positional order and orientational disorder which has been predicted to be impossible for this shape using hard colloidal models. With a combination of direct imaging and Monte Carlo simulation, we show that the nanoscale "non-hard" interactions render configurational entropy sufficient to randomize nanoparticle orientations and induce the crystallization into a 3D hierarchical plastic crystal. The long-standing hypothesized kinetic intermediates in nanoscale crystallization is also visualized and analyzed for the first time.

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