Probing chirality in self-assembled CdSe nanoplatelets ribbons with 3D TEM and STEM imaging

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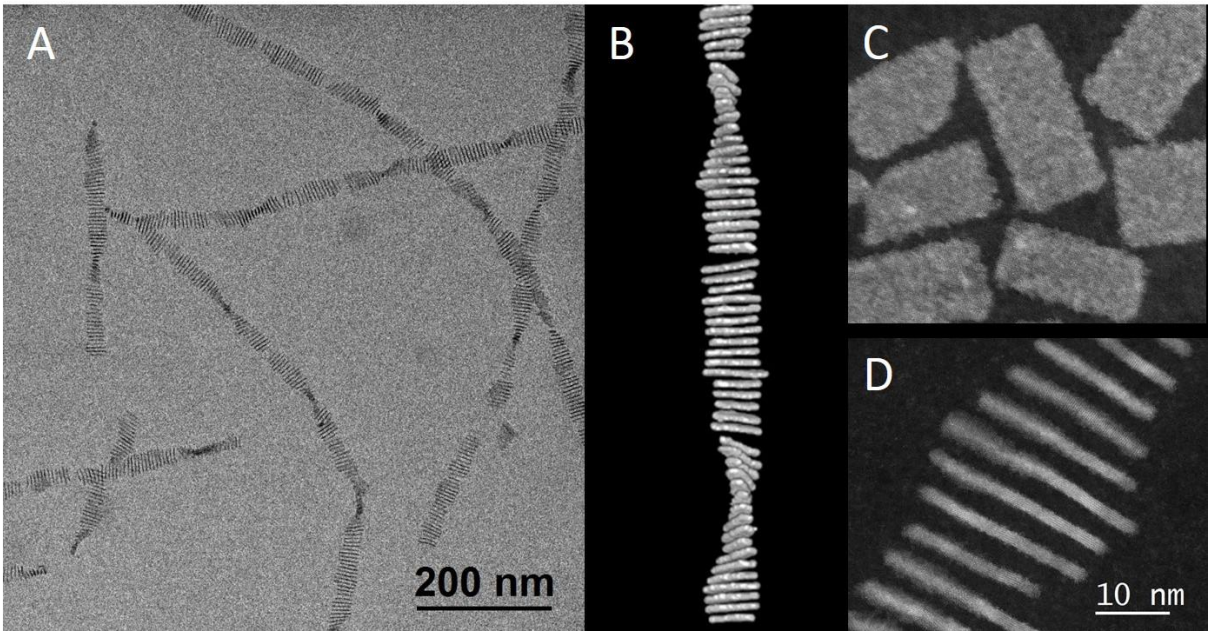
Chiral nanostructures are promising systems with novel electronic, photonic and magnetic properties. The availability of reliable methods of fabrication constitutes the main limitation for both applications and fundamental studies. Among nanoparticles, nanoplatelets constitute interesting systems due to their wide applicative potential. Recent studies describe original assemblies in two and three dimensions but chiral organizations have not yet been reported for these systems. In the present study, we investigate the formation of ribbons from colloidal CdSe nanoplatelets (figure A). Samples were characterized by TEM tomography for the determination of 3D structure (figure B) and by HAADF scanning TEM for atomic structure (figures C and D). We show that ribbons of stacked CdSe nanoplatelets twist upon addition of oleic acid ligand, leading to chiral ribbons that reach several micrometers in length and display a well-defined pitch of ~400 nm. We demonstrate that the chirality originates from the surface strain caused by the ligand since isolated nanoplatelets in dilute solution undergo a transition from a flat to a twisted shape as the ligand coverage increases. These results show that a ligand-induced mechanical stress can strongly distort nanoplatelets and that this stress is expressed at a larger scale.



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