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Circular Dichroism of a Semiconductor Nanowire with a Screw Dislocation

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Extended Abstract

The predominant origin of intrinsic chirality of semiconducting nanocrystals is still a subject of controversy. According to Elliott *et al.*, 2008, this chirality has two major sources: the surface and the core of the nanocrystal. We validate this concept by developing a unified theory of circular dichroism induced by a core defect, namely, a screw dislocation. Our theory assumes that the nanowire chirality comes from the dissymmetry of the dislocation-induced potential affecting the confined electrons. By going beyond the Rosenfeld approximation, we take into complete account the retardation of the electric field over the volume occupied by the nanowire. We unambiguously demonstrate that the presence of a screw dislocation in a cylindrical nanowire leads to the circular dichroism of its absorption bands. As shown by Jin *et al.*, 2008, and Bierman *et al.*, 2010, nanowires can be formed with dislocations; we therefore believe that optical activity is likely to be inherent to many kinds of semiconducting nanocrystals. Our study is of particular importance for the future development of photonics and nanobiotechnological applications. We believe that chiral semiconducting nanowires can potentially serve as new emitters of circularly polarized light, chemo- and biosensors, as well as nanoprobes for molecular recognition of various chiral molecules, including biopharmaceutical products and common drugs.

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