Screw Dislocation-Induced Mirror-Symmetry Breaking in Bulk Metal-Organic Crystals

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Mirror-symmetry breaking in crystals largely relies on arrangement of building units into either a specific chiral space group or a chiral morphology.[1] However, screw dislocation–a type of topological defects–can furnish certain nanocrystals with helical growth spirals without the use of any chiral building units or additives.[2] Although these helical structures have been frequently observed by using atomic force microscopy or electron microscopy,[2] the chirality of crystals are rarely identified due to the difficulty in characterizing both sides of crystals. Moreover, as the crystal size increases from nanoscale to microscale, the number of screw dislocations increases drastically, where helical spirals with either same or opposite handedness interact with each other, which may result in the disappearance of helicity.[3]

Here we report mirror-symmetry breaking in a bulk layer-structured metal-organic crystal (^{L}Cryst) induced by a single screw dislocation. A growth spiral with either clockwise (CW) or counterclockwise (CCW) direction develops consecutively from the geometric center of ^{L}Cryst to its peripheral edge, forming a spiral pyramid on the crystal surface. This indicates that bulky ^{L}Cryst bearing a single screw dislocation, though crystallographically achiral, is morphologically chiral due to screw dislocation-induced mirror-symmetry breaking.

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