How Do You Make a Gyroid Chiral?

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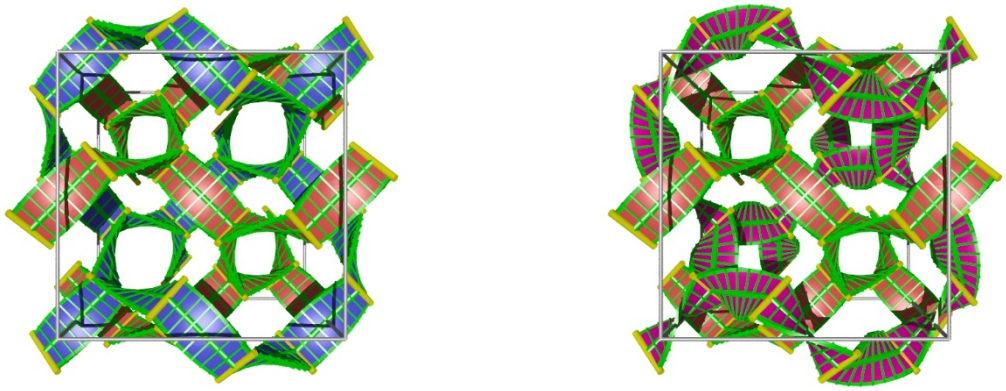
Among the intriguing bicontinuous self-assembled structures, the gyroid cubic is the most ubiquitous. It contains two interpenetrating networks of opposite chirality and is thus achiral if, as usual, the content of the two nets is the same (Figure 1a) [1]. However we now find that strongly chiral compounds can also form the gyroid cubic structure, but a chiral one instead. While achiral molecules follow the opposite twists of nets 1 and 2 in the gyroid structure, molecules with a chiral center in their rod-like core do not follow the 70° twist between junctions in net 2 and instead wind against it by -110° to still match the junction orientation [2]. The metastable chiral gyroid is a high-entropy high-heat-capacity mesophase. The homochirality of its nets makes its CD signal close to that of the stable chiral bicontinuous cubic (space group *I*23) phase with 3 isochiral nets [3]. The relationship of this supertwisted chiral gyroid mesophase to other bicontinuous mesophases, as well as other ways of forming and modifying the gyroid phase in both chiral and achiral compounds, will be discussed too.



(a) (b)

Figure 1: Models of a gyroid unit cell using spine-and-ribs ribbons, each rib representing a raft with molecules parallel to rib. (a) Achiral and (b) chiral gyroid. The "supertwisted" net in (b) is shown in purple.

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