C_{60} derivatives having self-assembly capabilities

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Construction of well-ordered structures of fullerene derivatives not only in the bulk but also on the surface are essential for creation of various functional materials. Fullerene however has spherical shape, and tend to form aggregates, which makes it difficult to construct the well-ordered structures. Herein we report self-assemblies of fullerene derivatives to form liquid crystals and photocurrent generating self-assembled monolayers with attaching the five feathers or legs onto the fullerene core.

Fullerene-containing liquid crystals are promising electro/photo active soft materials. However, taking into account the size and shape of the fullerene unit, the elaboration of liquid crystalline fullerene derivatives have represented a synthetic challenge. We synthesized badminton shuttlecock-shaped liquid crystalline molecules, in which five organic "feather" attaches to the [60]fullerene unit.[1-4] Installation of metal atoms into the shuttlecock molecules afforded novel mixed ferrocene-fullerene liquid crystals.

Fullerene is one of intriguing materials to construct photocurrent generating cells, because it shows high electron affinity and long-lived excited state upon photo-absorption. We synthesized pentapod fullerene derivatives with attaching five "legs" to immobilize molecules on indium-tin oxide electrodes.[5] Self-assembled monolayers were thus prepared, and exhibited switchable photocurrent direction by changing components (methylated compounds or iron complexes) and molecular orientation (standing upright or lying down).

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