

# Researchers Add New Member to Carbon Material Family, A Two-dimensional Monolayer Polymeric Fullerene

Synthetic carbon allotropes are fascinating for their outstanding properties and potential applications. Scientists have devoted decades to synthesizing new types of carbon materials. However, a two-dimensional fullerene, which possesses unique structure, has not been successfully synthesized until now.

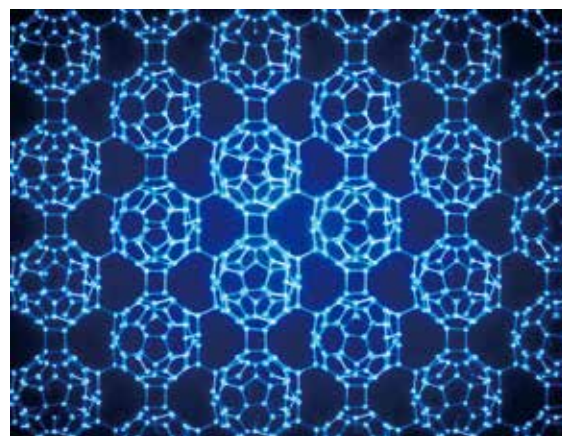
Recently, a research group led by Prof. ZHENG Jian from the Institute of Chemistry of the Chinese Academy of Sciences (ICCAS) developed a new interlayer bonding cleavage strategy to prepare a two-dimensional monolayer polymeric fullerene.

The researchers prepared magnesium intercalated  $C_{60}$  bulk crystals as the precursor to the exfoliation reaction. They then utilized a ligand-assisted cation exchange strategy to cleave the interlayer bonds into bulk crystals, which led to the bulk crystals being exfoliated into monolayer nanosheets.

The structure of monolayer polymeric  $C_{60}$  was explored by single crystal X-ray diffraction and scanning transmission electron microscopy (STEM). In this monolayer polymeric  $C_{60}$ , cluster cages of  $C_{60}$  are covalently bonded with each other in a plane, forming a regular topology that is distinct from that of conventional 2D materials.

Furthermore, the monolayer polymeric  $C_{60}$  exhibits an interesting in-plane anisotropic property and a moderate bandgap of 1.6 eV, which makes it a potential candidate for use in electronic devices.

“The work is the first to synthesize a monolayer



The structure of monolayer polymeric  $C_{60}$ . (Image by Ella Maru Studio)

polymeric fullerene. It is of great significance, as it adds a new member to the carbon material family,” ZHENG said. “This work has opened up a new research field in two-dimensional carbon material areas and the synthesis strategy could provide a unique perspective in exploring new carbon material.”

The study, entitled “*Synthesis of a monolayer fullerene network*” was published in *Nature*. The research was supported by the National Natural Science Foundation of China and CAS.

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**Reference**

Hou, L., Cui, X., Guan, B., et al. (2022). Synthesis of a monolayer fullerene network. *Nature*, 606(7914), 507-510. doi:10.1038/s41586-022-04771-5