Fullerene crystals with bimodal pore architectures

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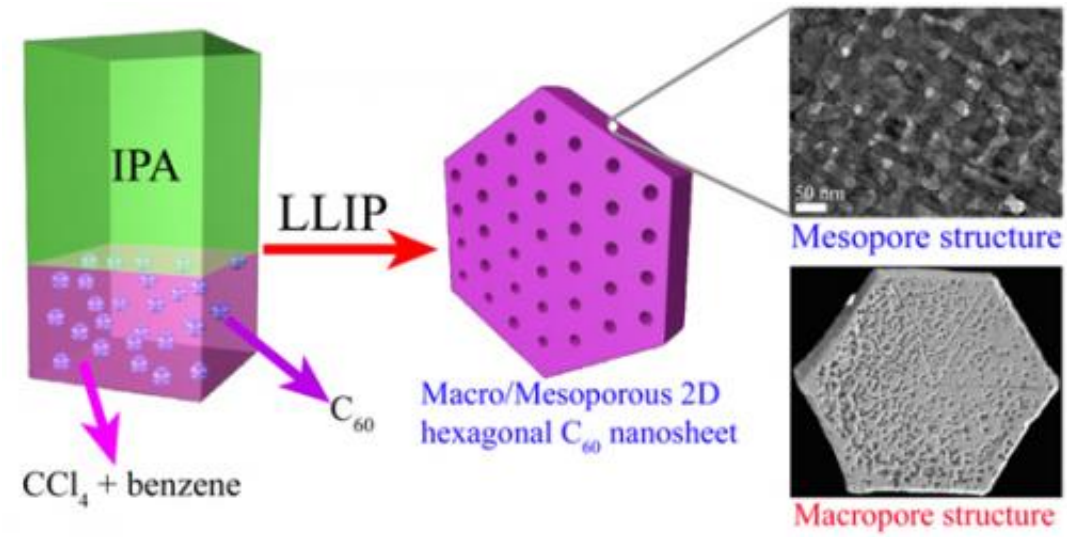

Synthetic route of producing mesoporous crystalline fullerene using a liquid-liquid interface

A research group headed by MANA Scientist Dr. Lok Kumar Shrestha of the Supermolecules Unit, for the first time demonstrated template-free novel mesoporous carbon material: fullerene (C_{60}) crystals with bimodal pore architectures and having highly crystallized framework. Experiments have proven that this novel meso- and macroporous material show better electrochemical performance compared to pristine C_{60} due to higher electrochemically active surface areas.

In this research, novel fullerene (C_{60}) crystals with bimodal mesoporous

and macroporous structures composed of a highly crystallized framework has prepared by using a liquid-liquid interfacial precipitation (LLIP) method involving the interface between isopropyl alcohol (IPA) and a saturated solution of C_{60} in a mixture of benzene and carbon tetrachloride (CCl_4). The resulting mesoporous C_{60} exhibits two-dimensional (2D) hexagonal plate morphology.

Porosity and electrochemically active surface area could be flexibly controlled by increasing the mixing fraction of CCl_4 and benzene. The synergistic effect of mixing solvents (CCl_4 and benzene) is mainly responsible for the formation of such porous structure. Otherwise, in an individual IPA/CCl_4 and IPA/benzene system, 2D plate like and 1D nanowhiskers morphology without pores are observed. In solution-based crystallization (LLIP method), solvent molecule gets entrapped during crystallization, which upon slow release/or evaporation creates a porous structure. It is expected that this methodological innovation will be a milestone for the production of highly crystalline carbon-based materials offering better performance in catalytic, electrochemical, and sensing properties.

These research results are recently published in *Journal of American Chemical Society*, 2013, 135, 586-589.

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