# Formation of micrometer-scale fullerene decagonal prisms crystal: from mesocrystal to single crystal

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Fullerene nano-/micro-crystals can be prepared by interfacial method, evaporation method, as well as the reprecipitation method. The polymorphy and the morphology of the solution-grown fullerene crystals depends on the organic solvents used. Although many solvates were successfully prepared in different systems, the formation mechanism of these structures is rarely studied.

Recently, a new type of crystal, so called "mesocrystal", has been found, which builds up from the nanostructure intermediates. Mesocrystals can be synthesized from many polymer-controlled crystallization routes, but the difficulty in inorganic crystallization systems is that mesocrystals are short-lived with life time usually less than one second and it is difficult to observe the intermediate process of the crystallization. The organic crystals, with relatively low lattice energy compared to the ionic inorganic crystals, have longer lifetime, but the crystals under electron beam are partly merged into single crystals and the original mesocrystal structure is still unseen.

In this paper, we use the reprecipitation method to prepare fullerene microcrystals. The morphology and the size of the microcrystals can be controlled by tuning the volume ratio of the poor solvent and the fullerene solution as well as the concentration of fullerene in the initial solution. Importantly, the experimental results revealed that the formation of fullerene microcrystals involves mesocrystal formation with subsequent crystallographic fusion to a single crystal

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