

Fullerene cube with manipulable micropockets

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Background

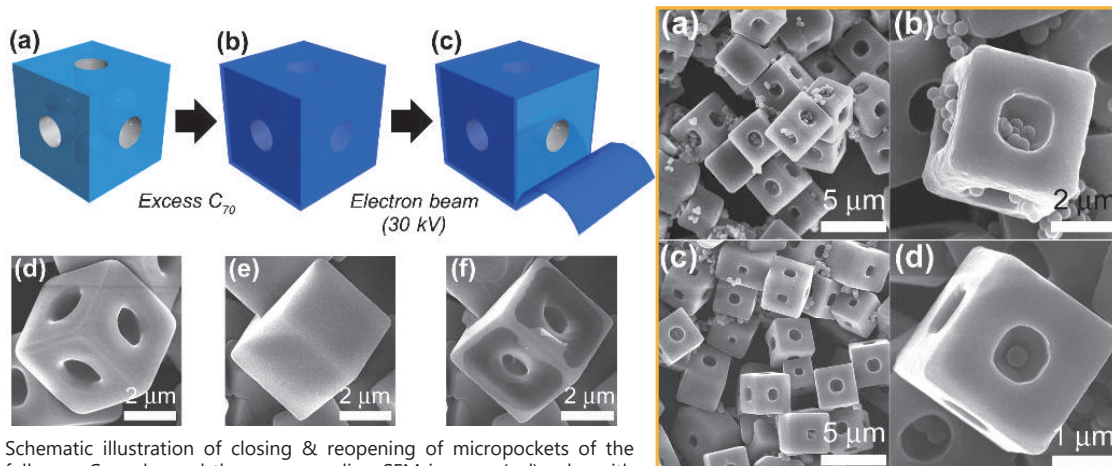
- The atomic and molecular level manipulation has been established and extensively studied using well-defined systems, and various functional materials and nanosystems have been designed.
- However, the manipulation of micron-size hollow object remains a key challenge.

Aim

- Fabrication of fullerene cubes with micron-sized pocket at the center of each faces.
- Controlled organization and directed manipulation of these micropockets for the encapsulation, protection, transport and release of nano/micron-size objects especially cells, bacteria, biomolecules and functional nanoparticles.

Advanced Research Topics

We succeeded to fabricate highly crystalline fullerene C_{70} cubes possessing micropockets at the center of each their faces using solution-based strategy. The pockets are isolated with a solid core at the interiors of the cubes can be intentionally closed or reopened. The micropockets of the cube exhibit preferential recognition of graphitic carbon particles over polymeric resin particles of similar dimensions due to the cubes' sp^2 -rich carboniferous nature.



Schematic illustration of closing & reopening of micropockets of the fullerene C_{70} cube and the corresponding SEM images: (a,d) cube with open micropockets, (b,e) closed pockets, and (c,f) cube with reopened pockets.

SEM images showing different loading capacities of the micropockets of the fullerene C_{70} cubes toward graphitic carbon (a,b) and polymer resin (c,d) particles of similar size.

- Publications**
- *Mater. Horiz.* **2018**, 5, 285 – 290.
 - *ACS Nano* **2017**, 11, 7790 – 7796.
 - *ACS Appl. Mater. Interface* **2017**, 9, 44458 – 44465.

Summary

- Dimensionally-integrated fullerene nanomaterials including mesoporous fullerene crystals could be prepared using a simple solution-based strategy.
- Controlled organization and intentional manipulation of micron-size fullerene hollow objects could be achieved.

Research outcome

- Micron-size hollow objects with controllable morphology composed of functional molecule fullerene C_{70} would be useful in specific and targeted applications such as protection of environmentally sensitive biological objects.
- Excellent materials for sensing aromatic vapors.