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Research Highlights

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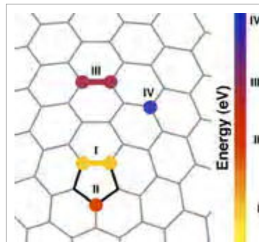
Giant fullerenes: Ever decreasing circles

Adarsh Sandhu

The 'shrink-wrapping' of giant fullerenes to form smaller structures, such as C_{60}, has been observed with a transmission electron microscope



Fullerenes, which are usually made from carbon, are hollow cage-like molecules with roughly spherical shapes. In spite of being discovered more than twenty years ago, the remarkable self-assembly processes that give rise to their well-known 'soccer-ball'-like structures from hot carbon vapour are still not fully understood. In particular, the 'shrink-wrapping' hypothesis, in which single layers of carbon sheets are wrapped into giant spheres that subsequently cast off carbon atoms until stable structures — such as C_{60} — are formed, has still not been experimentally verified.

Now, a team of researchers[1 (#B1)] in the USA have reported the first direct experimental evidence supporting this 'shrink-wrapping' mechanism. Jianyu Huang from Sandia National Laboratories, New Mexico and Boris Yakobson and colleagues from Rice University, Texas, USA show that giant fullerenes formed inside multiwalled carbon nanotubes evaporate to produce smaller buckyball structures and their carbon shell remains intact during this process. Individual nanotubes containing giant fullerenes were heated to above 2,000 °C by passing an electric current through them, and the resulting thermodynamically induced changes were monitored in real time with a high-resolution transmission microscope.

Theoretical modelling suggests that carbon atoms are removed preferentially from the higher-energy pentagon sites, and that the number of pentagons (12) remains constant as the fullerene shrinks. These results not only represent the first experimental evidence for a 'shrink-wrapping' formation mechanism, but also open up the possibility of making fullerenes that can be tailored to suit specific applications, such as for storing hydrogen in fuel cells.

REFERENCE

1. Huang, J. Y., Ding, F., Jiao, K. & Yakobsen, B. I. Real time microscopy, kinetics, and mechanism of giant fullerene evaporation. *Phys. Rev. Lett.* **99**, 175503 (2007). | **Article** (http://dx.doi.org/10.1103/PhysRevLett.99.175503) |