Latest News

March 3, 2009
Also appeared in print March. 9, 2009, p. 27

Materials Science

Graphene Via Arc Discharge

Electrical method yields sheets of carbon a few atoms thick

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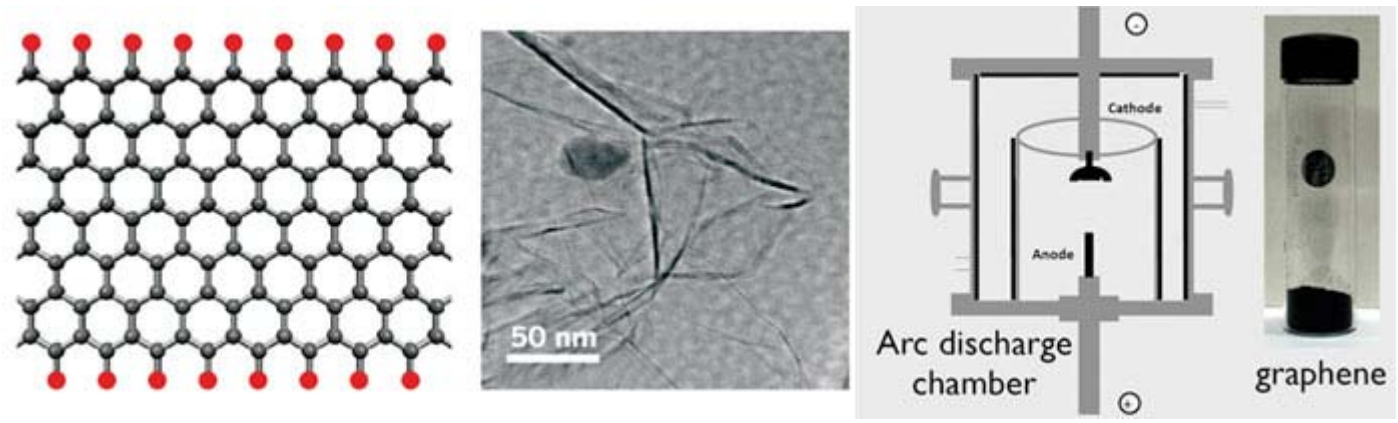
A simple electrical method provides an alternative way to prepare graphene samples, according to researchers in India. Graphene—one-atom-thick sheets of carbon packed in a honeycomb structure—has recently attracted considerable attention for its outstanding electronic and mechanical properties (C&EN, March 2, page 14). Single- and few-layer forms of the material have been made by peeling apart graphite, by multistep chemical methods, and by other laborious and complex techniques.

Now, Chintamani N. R. Rao and coworkers at the Jawaharlal Nehru Center for Advanced Scientific Research, in Bangalore, have demonstrated that a simple arc-discharge procedure yields graphene samples that are two to four layers thick (*J. Phys. Chem. C*, DOI: 10.1021/jp900791y). After maintaining a high-current, high-voltage arc between graphite electrodes in the presence of hydrogen, the team collected graphene flakes from one part of the interior of the apparatus. In contrast, they found multiwalled nanotubes, "onions," and other carbon materials specifically in the vicinity of the cathode.

The group also showed that the technique can be used to dope graphene with boron and nitrogen when the electrical discharge is formed in the presence of diborane and pyridine, respectively. By terminating dangling bonds (unsatisfied valencies) on carbon, hydrogen appears to play a key role in preventing the graphene sheets from rolling into nanotubes and graphitic particles, the team says.



C. N. R. Rao

Flakes In the presence of hydrogen (red, left image), an arc-discharge method produces graphene flakes two to four layers thick. Fitted with graphite electrodes, arc-discharge instruments , which previously have been used to make nanotubes and other helical carbon structures, can be operated in a way that yields graphene (right image).

Chemical & Engineering News
ISSN 0009-2347