A new form of carbon: Grossly warped 'nanographene'

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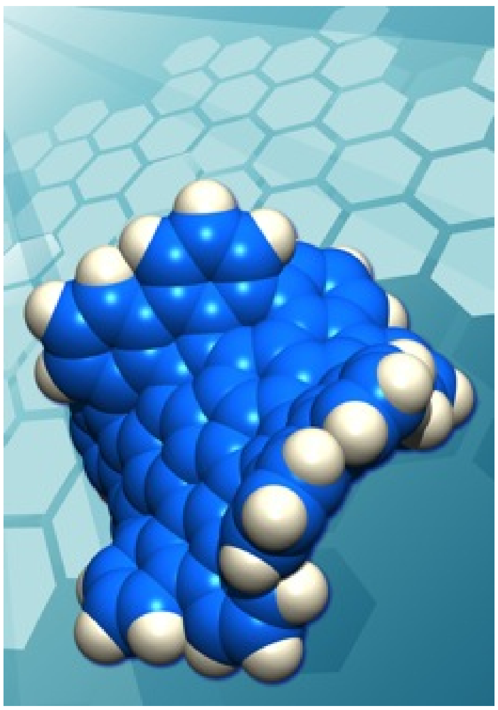

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Until recently, scientists had identified only two forms of pure carbon: diamond and graphite. Then in 1985, chemists were stunned by the discovery that carbon atoms could also join together to form hollow balls, known as fullerenes. Since then, scientists have also learned how to make long, ultra-thin, hollow tubes of carbon atoms, known as carbon nanotubes, and large flat single sheets of carbon atoms, known as graphene. The discovery of fullerenes was awarded the Nobel Prize in Chemistry in 1996, and the preparation of graphene was awarded the Nobel Prize in Physics in 2010.

Graphene sheets prefer planar, 2-dimensional geometries as a consequence of the hexagonal, chicken wire-like, arrangements of trigonal carbon atoms comprising their two-dimensional networks. The new form of carbon just reported in *Nature Chemistry*, however, is wildly distorted from planarity as a consequence of the presence of five 7-membered rings and one 5-membered ring embedded in the hexagonal lattice of carbon atoms.

Odd-membered-ring defects such as these not only distort the sheets of atoms away from planarity, they also alter the physical, optical, and electronic properties of the material, according to one of the principle authors, Lawrence T. Scott, the Jim and Louise Vanderslice and Family Professor of Chemistry at Boston College.

"Our new grossly warped nanographene is dramatically more soluble than a planar nanographene of comparable size," said Scott, "and the two differ significantly in color, as well. Electrochemical measurements revealed that the planar and the warped nanographenes are equally easily oxidized, but the warped nanographene is more difficult to reduce."

Graphene has been highly touted as a revolutionary material for nanoscale electronics. By introducing multiple odd-membered ring defects into the graphene lattice, Scott and his collaborators have experimentally demonstrated that the electronic properties of graphene can be modified in a predictable manner through precisely controlled chemical synthesis.

More information: A grossly warped nanographene and the consequences of multiple odd-membered-ring defects *Nature Chemistry* (2013) doi:10.1038/nchem.1704

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