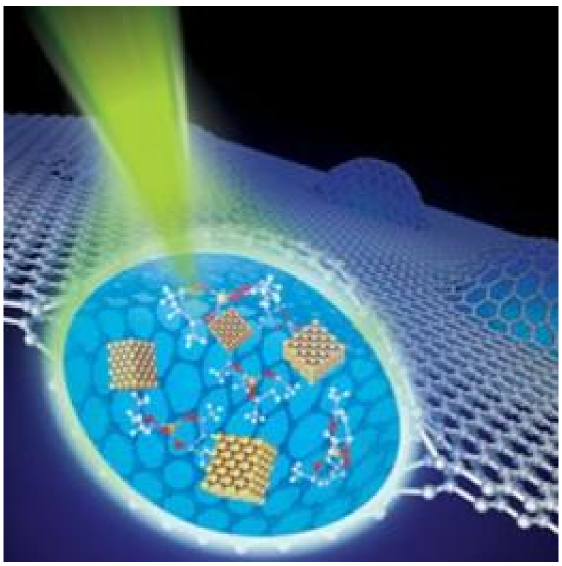
Physics group uses graphene to allow electron microscopy of liquid objects

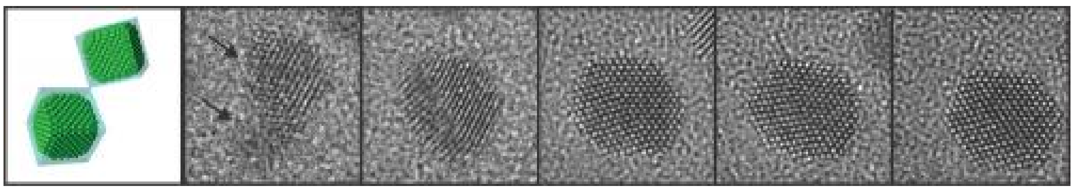
April 6 2012, by Bob Yirka



Image(c) Alivisatos, Lee and Zettl research groups, LBNL.

(Phys.org) -- News of new uses for graphene continue to come in with remarkable regularity, and now a team of physicists, as they describe in their paper published in the journal *Science*, have figured out a way to use it to create a sandwich that can be used to study objects under an electron microscope that are immersed in liquid.

Up till now, studying so-called wet chemistry objects using an electron microscope has been more than a little tricky. This is because such microscopes require specimens to be held in a vacuum while being dosed with electrons. Unfortunately, liquids tend to vaporize when put into a vacuum, making them pretty hard to study. Up to now, researchers have been forced to use less than optimal substances to hold the materials in place, such as silicon nitride. Unfortunately, because such materials tend to be rather thick, the images created using them haven't been of very high quality.



This shows TEM images of platinum nanocrystal coalescence and their faceting in the growth solution. Credit: KAIST

Graphene, as most know by now, is a single sheet of carbon atoms, highly touted for its unusual electrical properties, its transparency and of course it's strength. It's the second property that got this research team interested. They wondered what would happen if graphene was used to trap a liquid when placed in vacuum and then under an electron microscope. Because it's just one atom thick, they figured, it should allow for the creation of much higher quality images than they'd managed with other materials.

To find out, they created a sealed sandwich made up of two layers of graphene, covering a layer of platinum ions in a liquid solution. They wanted to see if they could actually watch platinum nanocrystals being formed, which would go a long ways towards understanding how the whole process works. They then placed the sandwich into the electron microscope vacuum to see how things progressed.

To sum up, it worked quite well. The group reports that they were able to watch the nanocrystals grow with remarkable clarity and don't see any reason why the same approach wouldn't work for other wet chemistry samples, which would open up the use of electron microscopy to a whole new area of science, namely, biochemistry.

There is the problem of how biological specimens react to being bombarded with electrons, essentially radiation, however. Thus far, no one really knows if the graphene will provide any protection for the material being studied, but this team is anxious to find out. No doubt once they do, another paper will be forthcoming describing those results as well.

More information: High-Resolution EM of Colloidal Nanocrystal Growth Using Graphene Liquid Cells, *Science* 6 April 2012: Vol. 336 no. 6077 pp. 61-64. DOI: 10.1126/science.1217654

ABSTRACT
We introduce a new type of liquid cell for in situ transmission electron microscopy (TEM) based on entrapment of a liquid film between layers of graphene. The graphene liquid cell facilitates atomic-level resolution imaging while sustaining the most realistic liquid conditions achievable under electron-beam radiation. We employ this cell to explore the mechanism of colloidal platinum nanocrystal growth. Direct atomic-resolution imaging allows us to visualize critical steps in the process, including site-selective coalescence, structural reshaping after coalescence, and surface faceting.

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