Researcher investigates new material grown from sugar

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(PhysOrg.com) -- Ordinary table sugar could be a key ingredient to developing much lighter, faster, cheaper, denser and more robust computer electronics for use on U.S. military aircraft.

Though admittedly far in the future, recent results from a program led by chemist and Rice University professor, Dr. James Tour demonstrate another example of the cutting-edge basic research.

Tour and his colleagues at Rice have developed a relatively easy and controllable method for making pristine sheets of graphene --- the one-atom-thick form of carbon --- from regular table sugar and other solid carbon sources.

"Dr. Tour is exploring a chemical approach to producing high quality carbon based nanostructures such as nanotubes and graphenes with well defined properties," said AFOSR program manager, Dr. Charles Lee.

In their method, a small amount of sugar is placed on a tiny sheet of copper foil. The sugar is then subjected to flowing hydrogen and argon gas under heat and low pressure. After 10 minutes, the sugar is reduced to a pure carbon film, or a single layer of graphene. Adjusting the gas flow allowed the researchers to control the thickness of the film.

The use of solid carbon sources like sugar has allowed Tour to stay away from the more cumbersome chemical vapor deposition method and the high temperatures associated with it. His one-step, low-temperature

process makes graphene considerably easier to manufacture.

"In a traditional CVD point of view, it was straightforward to optimize the pristine graphene's quality through adjusting the growth conditions and the metal catalysts with continuous gas sources (CH_4 or C_2H_2)," explained Tour. "With this technique using different kinds of solid carbon sources, more benefits such as graphene doping and thickness control could be realized."

According to Tour, doped graphene opens more possibilities for both Air Force and commercial electronics applications. Pristine graphene has no bandgap, but doped graphene allows for manipulation of electronic and optical properties, important factors for making switching and logic devices.

"These materials can be used in advanced electronics, photonics as well as structural applications for the Air Force," explained Lee.

While the Air Force is focusing primarily on potential electronics applications, many other commercial and medical uses could be possible, including transparent touch screen devices, special biocompatible films for surgery of traumatic brain injuries, faster transistors in personal computers or thin materials for solar energy harvesting.

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