

One box of Girl Scout Cookies worth \$15 billion

August 4 2011

Scientists can make graphene out of just about anything with carbon -- even Girl Scout Cookies.

Graduate students in the Rice University lab of chemist James Tour proved it when they invited a troop of Houston Girl Scouts to their lab to show them how it's done.

The work is part of a paper published online today by *ACS Nano*. Rice scientists described how graphene -- a single-atom-thick sheet of the same material in pencil lead -- can be made from just about any [carbon source](#), including food, insects and waste.

The cookie gambit started on a dare when Tour mentioned at a meeting that his lab had produced graphene from table sugar.

"I said we could grow it from any carbon source -- for example, a Girl Scout cookie, because Girl Scout Cookies were being served at the time," Tour recalled. "So one of the people in the room said, 'Yes, please do it. ... Let's see that happen.'"

Members of Girl Scouts of America Troop 25080 came to Rice's Smalley Institute for Nanoscale Science and Technology to see the process. Rice graduate students Gedeng Ruan, lead author of the paper, and Zhengzong Sun calculated that at the then-commercial rate for pristine graphene -- \$250 for a two-inch square -- a box of traditional Girl Scout shortbread cookies could turn a \$15 billion profit.

"That's a lot of cash!" said an amazed Sydney Shanahan, a member of the troop.

A sheet of graphene made from one box of shortbread cookies would cover nearly 30 football fields, Sun said.

The experiment was a whimsical way to make a serious point: that graphene -- touted as a miracle material for its toughness and conductivity since its discovery by Nobel Prize-winning scientists Andre Geim and Konstantin Novoselov in 2004 -- can be drawn from many sources.

To demonstrate, the researchers subsequently tested a range of materials, as reported in the new paper, including chocolate, grass, polystyrene plastic, insects (a cockroach leg) and even dog feces (compliments of lab manager Dustin James' miniature dachshund, Sid Vicious).

In every case, the researchers were able to make high-quality graphene via carbon deposition on copper foil. In this process, the graphene forms on the opposite side of the foil as solid carbon sources decompose; the other residues are left on the original side. Typically, this happens in about 15 minutes in a furnace flowing with argon and hydrogen gas and turned up to 1,050 degrees Celsius.

Tour expects the cost of graphene to drop quickly as commercial interests develop methods to manufacture it in bulk. Another new paper by Tour and his Rice colleagues described a long-sought way to make graphene-based transparent electrodes by combining graphene with a fine aluminum mesh. The material may replace expensive indium tin oxide as a basic element in flat-panel and touch-screen displays, solar cells and LED lighting.

The experiment the Girl Scouts witnessed "has a lot to do with current

research topics in academia and in industry," said Tour, Rice's T.T. and W.F. Chao Chair in Chemistry as well as a professor of mechanical engineering and materials science and of computer science. "They learned that carbon -- or any element -- in one form can be inexpensive and in another form can be very expensive."

Diamonds are a good example, he said. "You could probably get a very large diamond out of a box of Girl Scout Cookies."

Provided by Rice University

Citation: One box of Girl Scout Cookies worth \$15 billion (2011, August 4) retrieved 25 April 2024 from <https://phys.org/news/2011-08-girl-scout-cookies-worth-billion.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.