Graphene Recipe Yields Carbon Cornucopia >>

The hottest material in physics these days is graphene, sheets of carbon just a single atom thick. Graphene is flexible yet harder than diamond. It conducts electricity faster at room temperature than anything else. And it’s nearly transparent, a handy property for devices such as solar cells and displays that need to let light through. The only trouble is that people have been able to make only small flakes of the stuff—until now.

At the meeting, Alfonso Reina Cecco, a graduate student in chemist Jing Kong’s lab at the Massachusetts Institute of Technology (MIT) in Cambridge, reported that he and several colleagues have come up with a cheap, easy way to grow high-quality graphene films and then transfer them wherever they want. “That’s a big deal,” says Andre Geim, a physicist at the University of Manchester, U.K., who first reported making graphene (Science, 22 October 2004, p. 666), “It promises wafer [of graphene]. That changes everything.” It opens the door both to better ways of exploring the new physics of atomically thin materials and to potential applications.

To create the first graphene sheets in 2004, Geim peeled single layers of graphene off chunks of graphite with clear tape. But that low-tech approach would be hard to scale up for industrial use. Researchers at the Georgia Institute of Technology in Atlanta came closer in 2004 by growing graphene films atop a substrate made of silicon carbide. Instead, they deposited a film of nickel atop a standard silicon wafer. They then used a conventional film-growing technique known as chemical vapor deposition to add graphene in either a single sheet or a stack of a few sheets.

To transfer their graphene sheets to another surface, the MIT team coated it with a polymer known as PMMA, then etched away the silicon and the nickel after that, leaving only the graphene on the polymer film. Finally, they covered the newly reexposed graphene surface with glass and then dissolved away the PMMA. By initially patternning the nickel layer, Cecco and his MIT colleagues also showed that they could make graphene films in arbitrary patterns, such as electronic devices. The same day Cecco gave his talk, a paper on the topic was published online in Nano Letters.

This ability to pattern and place graphene wherever it’s needed, Geim says, will only increase the amount of research done with the material, ensuring that it will stay among the hottest materials in physics. –R.F.S.

A new biochip analyzes a single drop of blood plasma for up to a dozen different protein indicators of disease. Because the new chips are cheap and fast, they could revolutionize medical diagnostics.

(>Caltech) in Pasadena, reported that his team has made microfluidic chips that can detect and quantify levels of a dozen different proteins in blood plasma simultaneously. What is more, the test needs only a single drop of blood, which it can analyze in less than 10 minutes. Because such chips are cheap and easy to manufacture, they could drop the lab costs to just pennies per test, Heath says.

“If we can develop simple devices [for finding disease markers in plasma], that could be a big development for global health,” says Samir Hanash, a proteomics expert at the Fred Hutchinson Cancer Research Center in Seattle, Washington. Still, even though this new device makes strides toward that goal, he cautions that proving the device can work reliably under a wide range of conditions remains a distant prospect.

In coming up with their new chip, Heath’s team combined recent innovations in microfluidic chips and DNA arrays, both of which have been advancing rapidly in recent years. The Caltech researchers used standard microfluidic chip-patternning techniques to carve a series of large and small channels in a thin polymer film. Then they bonded the film to a glass slide patterned with 12 strips of antibodies to specific proteins. The resulting device separates blood plasma from whole blood cells, then steers the plasma and the proteins it contains over the antibody arrays for analysis. Fluorescence analysis then reveals any proteins bound to the array, creating a bar-code readout of which proteins are present from each blood sample. When different concentrations of the same antibodies are placed on different strips, the chips can also determine the abundance of target proteins as well.

Using their new chip, the members of the Caltech team showed that they could sort 22 cancer patients into different groups based on which of 12 different proteins associated with cancer were in their blood. Heath says he and his colleagues have formed a company in hopes of commercializing the technology. –ROBERT F. SERVICE

Film star. Graphene is prized for its electrical properties. Now, researchers can make sheets of the atomically thin material and pattern them for devices.