Making massive MIMOs

Massive arrays of miniature graphene antennas are set to enable high speed short range communications in the terahertz spectrum. By Graham Pitcher.

“When electrons in graphene are excited by an incoming electromagnetic wave, they start moving back and forth,” Prof Akyildiz explained. “Because of graphene’s properties, this global oscillation of electrical charge results in a confined electromagnetic wave on top of the graphene layer.”

It would be possible to take advantage of plasmons in metals such as silver and gold, but this would mean devices operating at hundreds of THz. “While those frequencies might offer advantages in communication speed,” Prof Akyildiz, pointed out, “their range would be limited by propagation losses to just a few microns.” And copper is ruled out because it doesn’t support plasmons.

The nano antenna developed by the Georgia Tech team, working with researchers from SUNY, comprises a layer of graphene on a dielectric and a ground plane. “The graphene must be on top of a dielectric, such as gallium arsenide,” Prof Akyildiz said. “Metallic antennas don’t need this extra layer. It’s not like we have taken a classical design and used graphene; there’s a lot of IP involved in our antenna.”

While the team is working on single...
Printable antennas may bring low cost and flexibility to a range of applications

Researchers from the University of Manchester have used compressed graphene ink to print an RF antenna measuring 14cm x 3.5mm onto a piece of paper. According to the team, the antenna performed well enough to make it practical for use in RFID tags and wireless sensors.

Graphene ink is usually made by mixing graphene flakes with a solvent, and sometimes a binder. Graphene ink with binders usually conducts electricity better, but only after the binder – an insulator – is broken down by annealing. But this high temperature process limits the surfaces onto which graphene ink can be printed.

The team found that by printing and drying the ink, then compressing it with a roller, graphene’s conductivity was increased by more than 50 times.

Researcher Dr Zhirun Hu said: “What makes printed graphene attractive for antenna applications is its ultra low cost and flexibility and the fact that it can be printed on any substrate without needing a high temperature process. We can use screen printing to produce graphene antennas, which suits low cost mass production.”

Expanding, Dr Hu noted: “Being able to print antennas on any substrate means we could see a disruptive technology for low cost, wearable communications products. In addition, we’ll be able to print a complete RF transceiver in the near future.”