Graphene finding could lead to super-fast Internet

British scientists have devised a way of using graphene, the thinnest material in the world, to capture and convert more light than previously, paving the way for advances in high-speed Internet and other optical communications.

In a study in the journal Nature Communication, the team -- which included last year's Nobel Prize-winning scientists Andre Geim and Kostya Novoselov -- found that by combining graphene with metallic nanostructures, there was a 20-fold enhancement in the amount of light the graphene could harvest and convert into electrical power.

Graphene is a form of carbon just one atom thick and yet 100 times stronger than steel.

"Many leading electronics companies consider graphene for the next generation of devices. This work certainly boosts graphene's chances even further," said Novoselov, a Russian-born scientist who with Geim won the 2010 Nobel Prize for physics for research work on graphene.

Previous research has shown that electrical power can be generated by putting two closely-spaced metallic wires on top of graphene and shining light on the whole structure, effectively making a simple solar cell.

The researchers explained that due to the particularly high mobility and velocity of the electrons in graphene, such graphene cell devices can be incredibly fast -- tens or potentially hundreds of times faster than communication rates in the fastest Internet cables currently in use.

The main stumbling block to practical applications has so far been the cell devices' low efficiency, the researchers said. The problem is that graphene absorbs little light -- only around 3 percent -- with the rest going through without contributing to the electrical power.

In a collaboration between the Universities of Manchester and Cambridge, Novoselov's team found they could solve this problem by combining graphene with tiny metallic structures known as plasmonic nanostructures, which are specially arranged on top of graphene.

By using the plasmonic enhancement, the light-harvesting performance of graphene was boosted by 20 times without sacrificing any of its speed, they wrote in their study. Future efficiency could be improved even more, they said.

"We expected that plasmonic nanostructures could improve the efficiency of

graphene-based devices but it has come as a pleasant surprise that the improvements can be so dramatic," said Alexander Grigorenko, an expert in plasmonics and a leading member of the team. "Graphene seems a natural companion for plasmonics."

Andrea Ferrari of Cambridge University's engineering department, who also worked on the team, said the findings show graphene's great potential in photonics and in developing electronic devices that channel and control light. He said the combination of its special optical and electronic properties with plasmonic nanostructures could be fully exploited.

(Reporting by Kate Kelland; Editing by Roger Atwood)

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