

Graphene shown to enhance light-harvesting performance

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Researchers at the universities of Cambridge and Manchester have demonstrated a 20-fold enhancement in harvesting light by graphene — a development that could lead to advances in high-speed internet.

By putting two closely spaced metallic wires on top of graphene and shining light on this structure, researchers previously showed that this generates electric power.

More importantly, such graphene devices can be tens and potentially hundreds of times faster than communication rates in the fastest internet cables, which is a result of the unique nature of electrons in graphene, their high mobility and their high velocity.

Low efficiency has, however, hindered practical applications for these devices as graphene absorbs approximately three per cent light, with the rest going through without contributing to the electrical power.

The Manchester researchers have solved the problems by combining graphene with tiny metallic structures, specially arranged on top of graphene.

These so-called plasmonic nanostructures have enhanced the optical electric field felt by graphene and effectively concentrated light within the one-atom-thick carbon layer.

By using the plasmonic enhancement, the light-harvesting performance of graphene was reportedly boosted by 20 times, without sacrificing any of its speed.

Prof Andrea Ferrari, from the Cambridge engineering department, who led the Cambridge effort in the collaboration, said: 'So far, the main focus of graphene research has been on fundamental physics and electronic devices.

'These results show its great potential in the fields of photonics and optoelectronics, where the combination of its unique optical and electronic properties with plasmonic nanostructures can be fully exploited, even in the absence of a band gap, in a variety of useful devices, such as solar cells and photodetectors.'

The research is published in the journal *Nature Communications*.

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