



Team demonstrates printed electronics with graphene inks

24 November 2011 | By [Andrew Czyzewski](#)

Cambridge engineers have demonstrated printed electronics with graphene-based inks.

It is believed to be the first example of using the one-atom-thick layer of carbon in conjunction with inkjet technology and could deliver on the promise of cheap, flexible electronics for everyday items and clothes.

Printed electronics using conducting polymer inks have shown some early promise in applications such as digital paper and disposable radio-frequency identification (RFID) tags.

The obvious advantage is you do not need multi-billion-dollar fabrication facilities, it can be a very cheap and fast roll-to-roll process,' said project collaborator Dr Tawfique Hasan of Cambridge University. But the main stumbling block is the speed of the devices and that's what we've tried to improve here.'

The main problem with current inks is their low electron mobility, limiting them to very simple electronics with basic transistors. Graphene, which has excellent electrical conductivity and mobility owing to its hexagonal lattice arrangement of atoms, could augment currently available inks.

You need to consider the rheology of graphene-based inks, for example, viscosity, density all these things. That was one of the major achievements,' Hasan noted.

The researchers started with a block of pure graphite and exfoliated layers of graphene, filtering them to remove any that might block the printer heads.

It [graphite] resembles a book, where each individual page represents graphene, so what we do is use ultrasonication, which basically takes each page out separately from the book, and we use a solvent whose surface energy matches graphene so it [graphene] doesn't go back again and join with the graphite,' Hasan said.

The group has now demonstrated a simple transparent thin-film transistor device with a mobility of around $95\text{cm}^2\text{V}^{-1}\text{s}^{-1}$, and 80 per cent transmittance with $30\Omega\text{k/sq}$ sheet resistance. This compares favourably with current inks, although the group believes it can make greater improvements.

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- Anonymous | 24 Nov 2011 5:22 pm

This is great and very promising technology. We have to make sure that the UK can benefit fully from this. The printing machines themselves need to be designed, developed and made in the UK and exported worldwide. Then many more companies need to be doing the manufacturer of the end products here as well. As well as the sheer brilliance and inventiveness going into the technology that aspect needs to be approached with the same level of innovation.

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