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Nanomembranes get tough

27 May 2008

A new chemical approach to making strong carbon films less than 5nm thick could help speed their use in molecular sieves and flexible displays, according to researchers in the US.

The tough nanomembranes made by the team, led by Jeffrey Moore and John Rogers at the University of Illinois at Urbana-Champaign, come in a variety of shapes and sizes, including balloons, tubes and pleats.

The team used a two-step process to make the films, starting with a solution of alkyne-containing monomers, which self-assemble on a substrate as a single molecule layer. Then, in the presence of a molybdenum or copper catalyst, the molecules cross-link to form a carbon-rich film. The membranes can be produced as flat sheets, or on silica beads, optical fibres and corrugated surfaces to create different shapes.

In theory, the size of the monolayer that can be produced is unlimited. The unique feature of the method, however, is the degree of control it provides over the composition of the membranes, says Moore. 'We can build these sheets from the molecular level up - a molecular building block approach.'

The team think this ability to fine tune the structure of the nanomembranes could make them useful as molecular sieves. But their long term goal is to make membranes that have more interesting electronic properties and are easier to make than other promising materials such as graphene. Current techniques for producing graphene rely on rubbing bulk graphite across a hard surface to yield graphene flakes.

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- Jeffrey Moore

'We believe that the combination of an electronically interesting material that can be manipulated in some of these more exotic ways could really open up a lot of unusual electronic structures,' says Moore.

Kos Galatsis, who studies nanoelectronics at the University of California, Los Angeles, is sceptical about the team's plan to use their new method to produce materials for semiconductors. 'It may indeed increase strength by including carbon, but from a electronic transport property point of view, there is not much there.'

The team concede that they don't yet have a material that could be applied in high-end computing. However, they believe they will within a far shorter timescale be able to create films for flexible displays, which may eventually replace screens on computers and handheld devices such as PDAs.

Hayley Birch

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References

M J Schultz *et al*, *Proc. Natl. Acad. Sci. USA*, 2008, **105**, 7353.

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