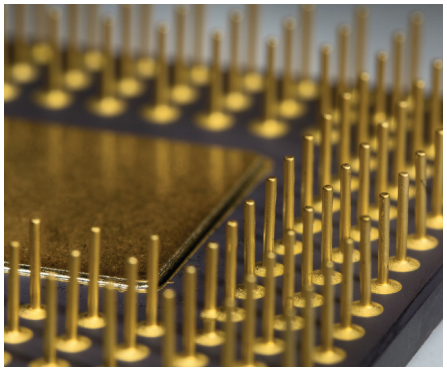
THE SUPER-SKINNY MATERIAL THAT COULD TRANSFORM ELECTRONICS

IMPACT!



↗ 200
times the strength of steel, graphene is the strongest material ever tested.

↗ Nanometre
Experimental graphene transistors are just a few nanometres across, a thousand times smaller than the transistors on silicon chips.

Sheets of carbon just a single atom thick could herald a new generation of electronics devices thanks to research supported by EPSRC. Although these graphene sheets are incredibly thin and flexible, they are also the strongest material ever tested and conduct electricity and heat exceptionally well.

Professor Andre Geim and colleagues at the University of Manchester invented graphene in 2004, with EPSRC support, despite theory telling them that materials just one atom thick couldn't be made. EPSRC funding is now helping researchers develop real-life applications for graphene.

GRAPHIC IMPACT

- → Graphene could be used to make next generation transistors that are a fraction of the size of current devices and so help miniaturise microelectronics, speed up computers and other devices.
- → Plugging the so-called "terahertz gap" between microwaves and infrared might be possible with graphene. This might allow satellite to aircraft communication and new non-invasive medical imaging.
- → Atomically, graphene could beat the clock, allowing new timekeeping devices for ultraprecision scientific experiments to be made accurate to one second in hundreds of millions of years.

Graphene, layer by layer

The discovery of graphene, a new form of carbon, which resembles a microscopic hexagonal mesh chicken wire, heralds a new era in materials science and electronics. Thanks to research at the University of Manchester, supported by EPSRC, this novel material could allow electronics devices to be built on a scale a thousand times smaller than silicon-based devices.

Stripped and super-skinny

Geim's team were hoping to make new materials that were as thin as possible when they found a way to synthesise a sheet of carbon just one atom thick. They began with its chemical cousin, graphite, the stuff of pencil "lead" and stripped it down layer by layer until they were left with a layer just one atom thick. Graphene was born – the strongest material ever tested, astonishingly stiff yet paradoxically flexible, and a phenomenal conductor of heat and electricity.

Thin sliced applications

The next step in the graphene story is to develop and test its potential in applications as diverse as electronics, medical imaging, and even airport security. It is the thinness of graphene, coupled with its electrical conductivity, that makes it useful for developing electronic components on a scale unattainable using semiconductors like silicon and gallium arsenide.

Tera in the sky

Graphene's peculiar properties also make it a potential candidate for building devices that work in the terahertz frequency range of the electromagnetic spectrum. This range lies between microwaves and the infrared. It holds the promise of a new type of imaging that can see inside objects without using hazardous X-rays. The same frequencies could also allow high-flying aircraft to communicate with satellites and the development of new sensors for detecting environmental pollutants.

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