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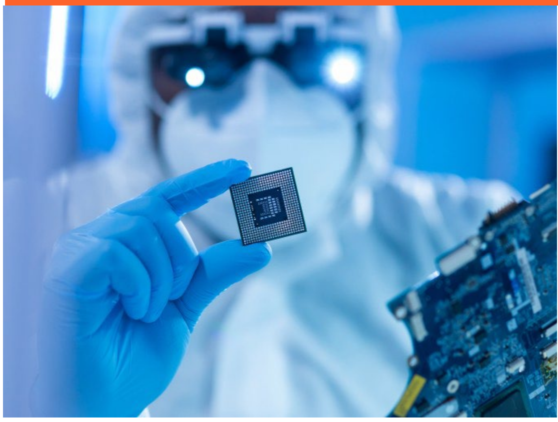
Beyond silicon: 2D materials for next generation electronics

Achieving ultra-clean interfaces in 2D materials enables production of field-effect transistors (FETs) with reproducible behavior and highly stable operation

Case: CHH-10452-23



Background: The semiconductor industry has transformed significantly over the past 70 years, driven by the miniaturisation of devices. In the last decade, the industry has focused on overcoming the physical limits of silicon technology scaling. This has led to the adoption of novel device geometries and materials to maintain Moore's law. Two-dimensional (2D) materials, such as transition metal dichalcogenides and graphene, have emerged as materials with significant potential.

The problem: Transistors with 2D semiconductors require industrially compatible gate dielectrics which have been deposited uniformly. Current deposition methods result in defects at the interface, negatively impacting device performance. Addressing these challenges is key to unlocking the full potential of 2D semiconductors in advanced electronics.

The solution: an electrodeposition method resulting in ultra-clean interfaces between a 2D semiconductor and gate dielectric material, enabling production of industrially compatible, high-quality FETs.

Researchers at the University of Cambridge have produced FETs with industrially compatible dielectric materials and 2D semiconductors, demonstrating ultra-clean interfaces with stable and reproducible FET behavior across hundreds of devices.

Commercialisation: We are now looking for commercial partners interested in helping us develop this technology. A patent application has been filed.

Benefits

2D semiconductor and gate dielectric material deposition method:

- Can be easily integrated with known deposition methods
- Enables ultra-clean interfaces between a 2D semiconductor and gate dielectric material

Field-effect transistors produced with ultra-clean interfaces:

- Composed of industrially compatible materials
- Highly stable device operation
- Reproducible transistor behaviour across hundreds of devices

Professor Manish Chhowalla

Manish Chhowalla is the Goldsmiths' Professor of Materials Science at the University of Cambridge. His research interests are in the fundamental studies of atomically thin two-dimensional transition metal dichalcogenides.

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