

ASX Announcement ([ASX: AXE](#))

31 March 2022

## Electronic transport in atom-thin graphene achieved

### Highlights

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- Archer achieves electronic transport in atom-thin graphene integrated with silicon electronics.
  - The work fundamentally links to using graphene transistor technology in the future operation of Archer's biochip.
  - Archer intends to use graphene in its biochip technology to enable ultrasensitive detection and analysis of diseases.
  - The biochip has been developed in-house by Archer staff and Archer owns 100% of the biochip technology intellectual property.
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Archer Materials Limited ("Archer", the "Company", "[ASX: AXE](#)") is pleased to provide shareholders with a technical progress update on Archer's 'lab-on-a-chip' technology ("biochip"). Archer owns 100% of the biochip technology intellectual property.

Recently, the Company announced that it had successfully integrated a single-atom-'thick' sheet of graphene with silicon electronics (ASX ann. [13 Jan 2022](#)). The 'thickness' of graphene is approximately 0.35 nanometres, with 1 nanometre being a billionth of a metre. Archer staff used state-of-the-art semiconductor chip fabrication instruments to repeatedly and reproducibly fabricate integrated graphene patterns and devices ("Integrated Device").

The Company has now successfully measured and confirmed the electronic transport in the Integrated Device (Image 1). The electronic transport results performed by Archer confirm that the atom-thin graphene electronic properties were retained post-processing and integration with silicon.

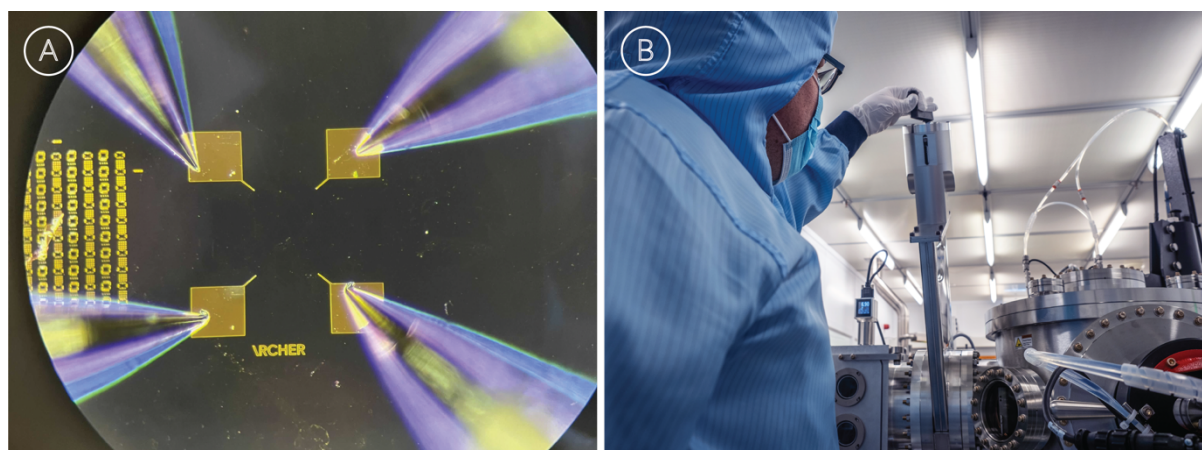
The work represents a significant technical achievement as the advanced, post-integration semiconductor foundry fabrication processes are complex, requiring the precision engineering of atomically thin graphene and devices to confirm the advantageous intrinsic materials' properties, which are fundamental to the scalability, biosensing functionality, and operation of Archer's biochip.

The Archer team performed current-voltage traces on the Integrated Devices, that were repeatedly and reproducibly recorded over various voltage ranges. The outcomes of the electronic transport measurements provide the necessary data and component level validation of the electronic parameters required to build graphene-based transistors integrated with silicon electronics.

The results of the direct electronic measurements performed on graphene pave the way for building graphene-based transistors (i.e. the core biosensing elements), which are required for the operation of Archer's biochip technology.

**Commenting on the biochip development, Archer CEO Dr Mohammad Choucair said:** “Prior to this latest work, Archer had achieved the integration of graphene in silicon electronics. Archer has now successfully performed complex post-integration lithography and atom-thick materials’ device processing that preserve graphene’s advanced electronic properties.

“The electronic transport measurements performed by the Archer team are the fundamental link with respect to using graphene in transistor technology intended for future biosensing operations in Archer’s biochip devices.”



**Image 1. A** Magnified view of an isolated graphene device undergoing direct measurement of electron transport. Several nanosized graphene devices are also visible (left). Electrodes connected to graphene are visible as gold coloured square patterns. Graphene is not visible in the image as it is atom-thin. **B** Graphene devices are fabricated and tested by Archer staff using highly specialised chip instrumentation in a semiconductor prototyping foundry.

### Further information on atom-thin graphene and its application in developing Archer’s biochip

The Company is developing a biochip that would allow droplets of biological specimens to be analysed and processed using graphene-based sensors. The biochip requires graphene materials in electronic circuits (i.e. the micro- and nanofabrication of graphene-based transistors), that would form miniaturised devices that act as ultrasensitive sensors for detecting and analysing biochemical targets, for example, to identify viruses or bacteria.

Graphene is an advanced material with electronic properties on the nanoscale that make its use for biosensing highly advantageous. It has unparalleled properties like high electron mobility and chemical stability in biologically relevant liquids that allow it to be used as an electrical conduit for sensing the activity of biological molecules. The electronic properties of graphene have been well studied scientifically in the field for over 15 years<sup>†</sup>.

Archer’s biochip design principles include the micro- and nano-fabrication of integrated sensing devices in regions of a chip that work alongside other fabricated functional regions *on the same chip* to process, detect and analyse biological specimens. Graphene, when integrated as part of a nanoelectronic device e.g. a transistor, would act as the sensing component of the biochip, to detect and process the biosensing signals. The work done by Archer to perform and confirm electronic transport in silicon-integrated, atom-thin graphene, is an important step in the potential future operation of Archer’s biochip.

<sup>†</sup> <https://www.nature.com/articles/s42005-021-00518-2>

## About Archer's biochip

Archer's biochip is lab-on-a-chip technology the Company is developing to enable the complex detection of some of the world's most deadly communicable diseases. The biochip development commenced in Nov 2020 (ASX ann. [5 Nov 2020](#)). Archer is currently focused on micro- and nano-fabrication of the biochip device components and combining these components with biochemical reactions to detect diseases (ASX ann. [1 Dec 2021](#)), which pose significant technological challenges to potentially commercialising lab-on-a-chip devices.

## About Archer

Archer is a technology company that operates within the semiconductor industry. The Company is developing and commercialising advanced semiconductor devices, including chips relevant to quantum computing and medical diagnostics.

The Board of Archer authorised this announcement to be given to ASX.

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