

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

28 September 2022

## On-chip electronic transport in qubit components achieved

### Highlights

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- Archer has made a significant step in the development of its <sup>12</sup>CQ quantum chip technology by nanofabricating devices that electrically integrate its qubit material.
  - The integration of the qubit material in an electrically controllable conducting circuit is a fundamental requirement for the operation of the <sup>12</sup>CQ chip.
  - The room-temperature on-chip electronic transport in Archer's qubit material supports the potential for practical solutions to quantum-enabled mobile devices.
  - Archer is the only ASX listed company and one of a few players in the world developing qubit processor technology.
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Archer Materials Limited ("Archer", the "Company", "[ASX: AXE](#)") is pleased to announce the Company has achieved on-chip electronic transport in qubit components at room temperature, as part of its <sup>12</sup>CQ quantum computing qubit processor chip ("<sup>12</sup>CQ chip") technology development. This achievement is a significant technological milestone and a fundamental requirement for the operation of the <sup>12</sup>CQ chip.

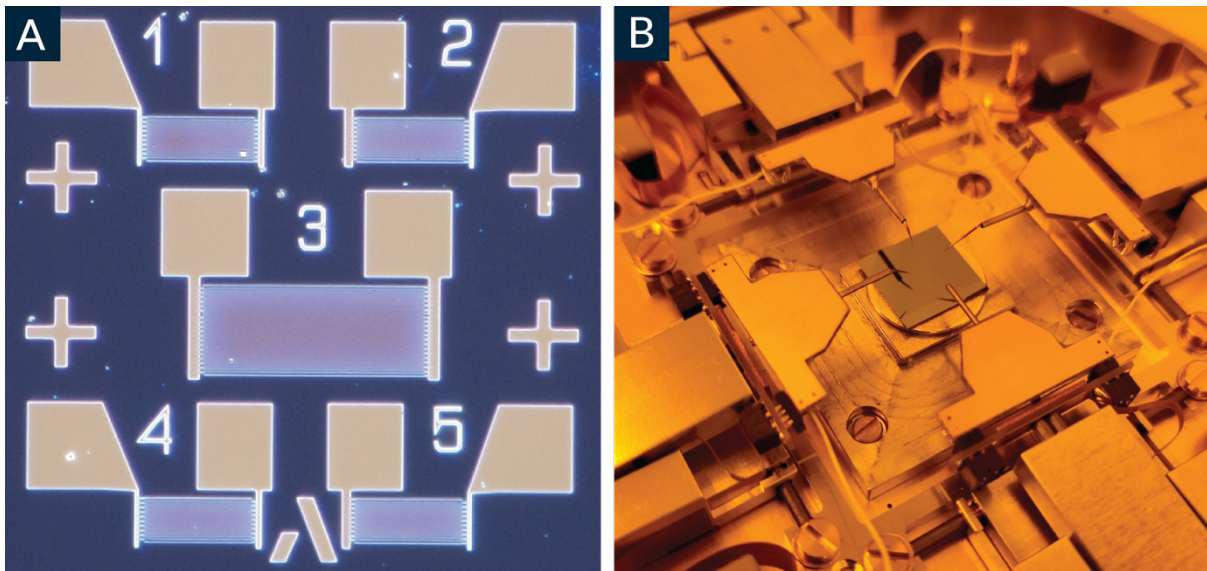
During the year, the Company has made considerable progress in the design and development of the <sup>12</sup>CQ chip, including:

- + The detection of quantum information in the <sup>12</sup>CQ material on-chip and at room temperature using mobile phone compatible technology (ASX ann. [1 Feb 2022](#)).
- + The fabrication of nanodevices that will allow probing of quantum behaviour in the <sup>12</sup>CQ qubit material, representing the first step towards the readout of quantum states from few and single qubits (ASX ann. [20 Jun 2022](#)).
- + Undertaking state-of-the-art 3D Electrostatic Finite Element Modelling in conjunction with in-house software development to simulate quantum electronic device architectures (ASX ann. [21 Jul 2022](#)).

Archer has now advanced its <sup>12</sup>CQ quantum chip development by nanofabricating devices containing electric circuits that integrate microscopic quantities of its carbon-based qubit material. The devices were fabricated on a silicon wafer using foundry-compatible lithography processes. Archer used the devices to demonstrate that a controlled electric current can be passed through the qubit material at room-temperature.

**Commenting on the <sup>12</sup>CQ chip development, Archer CEO Dr Mohammad Choucair said:** "For the potential use of Archer's qubit material in practical quantum processor chip devices, it is significant to demonstrate on-chip electronic transport in the qubit material at room temperature. The achievement is a significant step in Archer's <sup>12</sup>CQ chip development and paves the way for progress in our efforts aimed at qubit readout in chip-based devices."

The on-chip electronic transport characteristics of the qubit material are in agreement with previous state-of-the-art electronic transport measurements performed on *isolated* qubit material (ASX ann. [22 Feb 2021](#) and [15 Jun 2020](#)) that qualitatively and quantitatively validated the advantageous conductance properties of the qubit material in the context of quantum technology applications<sup>†</sup>.



**Image 1. On-chip electronic transport in Archer's qubit components. A** Five individual nanofabricated integrated devices, designed and purpose built by Archer staff, for the room temperature electronic transport measurements. **B** State-of-the-art instrumentation used in the electronic transport measurements, housed in an Australian semiconductor foundry.

#### Further information on Archer's global competitive advantage and tech differentiation

Archer's innovation in its <sup>12</sup>CQ chip development is aimed at nanofabricating devices integrating its unique qubit material, including the use of practical, modern-day electronic circuits. The qubit material is the core component of the <sup>12</sup>CQ chip. A fundamental requirement for the operation of the <sup>12</sup>CQ chip is to integrate the qubit in an electrically controllable conducting circuit.

The scientific breakthrough made in 2016 to realise Archer's <sup>12</sup>CQ qubit material is available online in the peer-reviewed scientific journal [Nature Communications](#), which reports the advantages, technological trade-offs, and the technological barriers that have been overcome towards realising practical quantum computing, over several other qubit proposals. Patent information related to the <sup>12</sup>CQ chip qubit and proposed device(s) is available online, including examiner reports, through the [WIPO website](#).

#### About Archer

Archer is a technology company developing advanced semiconductor devices, including processor chips that are relevant to quantum computing. Archer is developing the <sup>12</sup>CQ chip, a world-first qubit processor technology, that could potentially allow for quantum computing powered mobile devices ('QPMDs'). For more information, visit [www.archerx.com.au](http://www.archerx.com.au).

<sup>†</sup> <https://www.nature.com/articles/ncomms12232>

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

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