

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

14 October 2021

Early-stage validation of qubit robustness

Highlights

- Robustness of qubit coherence validated for the first time in an inert atmosphere at room temperature.
 - The work demonstrates a significant advantage over competing room-temperature qubit proposals that rely on high vacuum environments, such as ion-traps, that are difficult to integrate onboard mobile devices.
 - Archer is well-funded to progress its ¹²CQ chip technology development after recently raising A\$15 million via an institutional placement.
 - Archer is the only ASX listed company and one of a few players in the world developing qubit processor chip technology in the semiconductor industry[†].
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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 ¹²CQ quantum computing chip technology (“¹²CQ chip”).

The Company for the first time validated that the qubits’ quantum coherence properties[‡] are preserved under an inert atmosphere. Quantum coherence is the fundamental requirement for quantum logic operations that are the basis of *any* quantum computing qubit processor hardware. For potential integration and use of qubit materials in practical chip devices, it is significant to demonstrate and validate qubit robustness at room temperature and under atmospheric environments other than that of air or vacuum.

Qubit robustness further validates potential use in on-board mobile devices

The measurements to validate the qubit robustness were performed at room temperature using state-of-the-art electron spin resonance (“ESR”) instruments in Sydney, Image 1. Bulk quantities of Archer’s qubit material were subjected to an inert atmosphere comprising nitrogen gas, a commonly used and abundant gas that makes up 78% of air, which was found to preserve the qubits’ quantum coherence properties.

Other inert atmospheres that may preserve the qubits’ quantum properties are now subject to ongoing, routine optimisations of the external qubit environment by the Archer team.

Archer also found that the quantum properties of the bulk qubit material could be recovered even after the qubit material experienced shelf-lives exceeding years, and when placed under extreme exposure to high temperatures for at least several weeks (i.e. the qubit material withstood exceptional degradation conditions that are possible in chip-based environments).

[†] IBM Quantum Network: <https://www.ibm.com/quantum-computing/network/members/>

[‡] <https://www.nature.com/articles/ncomms12232>

Commenting on the recent progress, Archer CEO Dr Mohammad Choucair said: “The step-change optimisation that was achieved validates the robustness of the qubit for control measurements and operation that could be compatible with device miniaturisation and, in general, preserving qubit coherence when integrating with semiconductor devices.”

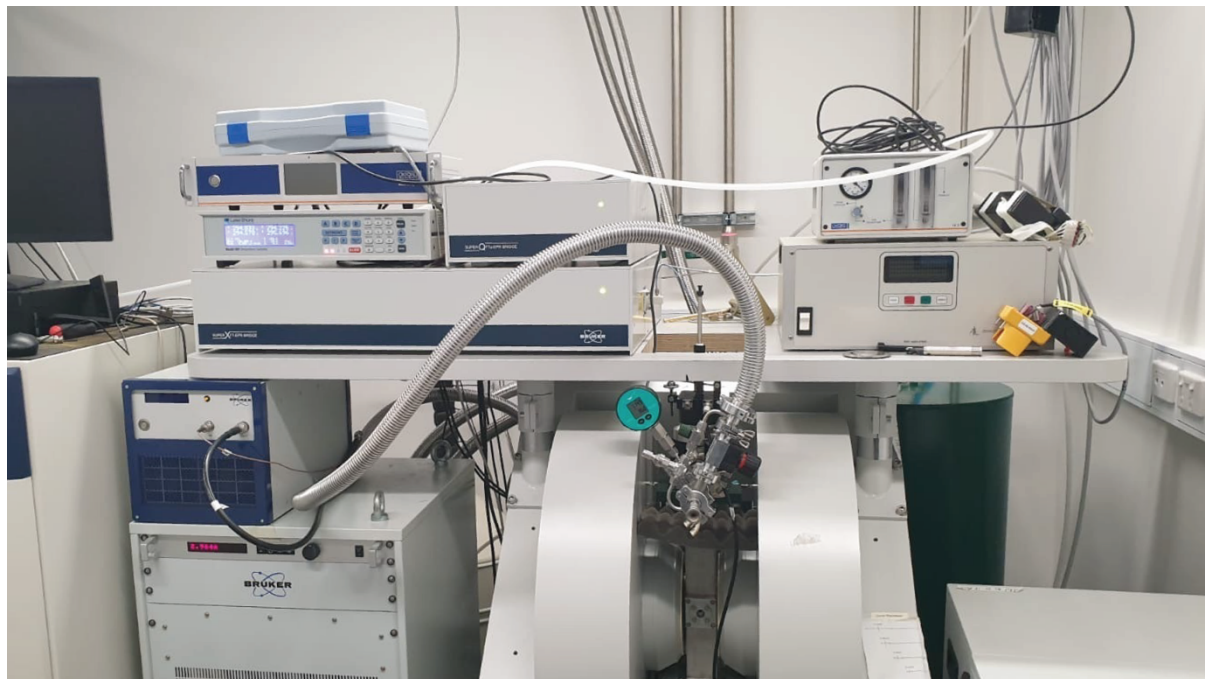


Image 1. Electron spin resonance setup to perform qubit control characterisation on bulk quantities of Archer's qubits at room temperature. Archer accesses the instrumentation to validate qubit robustness, including in various environmental conditions, in Sydney, Australia.

About Archer

Archer is a technology company developing advanced semiconductor devices, including processor chips that are relevant to quantum computing. Archer is developing the ¹²CQ chip, a world-first qubit processor technology, that could allow for quantum computing powered mobile devices ('QPMDS'). For more information, please view Archer's [webinar](#) with IBM.

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

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