Archer Materials
Technology

Archer Materials Limited (ACN: 123 993 233)
Lot Fourteen, Frome Road, Adelaide SA 5000
www.archerx.com.au

ASX Announcement (ASX: **AXE**) 13 February 2025

Archer demonstrates spin detection using resonant circuits: a key step toward building a qubit for use in a quantum computer

Highlights

- Archer has achieved a key step toward qubit control. The company's proprietary resonator design was successfully able to detect the spin of its carbon based quantum material.
- This result brings Archer a step closer to achieving spin state control, required for the ^{12}CQ chip.
- The result highlights the uniquely high spin density and significant spin lifetime of Archer's novel carbon-based spin material.
- The next stage of the ^{12}CQ project will be to demonstrate feasibility for readout and control by the end of 2025.
- Following demonstration of readout and control Archer will then progress to development of a functional qubit which is targeted for H1 2026.

Archer Materials Limited ("Archer", the "Company", "ASX: AXE"), a semiconductor company advancing the quantum technology and medical diagnostics industries, has demonstrated a key step to qubit control.

Archer has been able to observe the strong coupling of spin states of the Company's novel carbon-based spin material (ASX announcement 8 January 2025), to a superconducting resonator.

The results is a key milestone in Archer's development of qubit control, required for the ^{12}CQ project.

Previous generations of superconducting resonators (ASX announcement 3 September 2024 were unable to detect the spin of the quantum material. Interactive design optimisation, simulation, and testing by the Archer team resulted in the new resonator circuit design, with the clarity of the spin detection measurement exceeding expectation.

Commenting on the ^{12}CQ developments, Greg English, Executive Chair of Archer commented:

"The team has done great work in controlling the quantum spin states for Archer's novel carbon-based film qubit material. They did this by developing new resonator circuits to overcome the challenge of coupling extremely short bursts of microwave power into nanoscale volumes of material, without disrupting the neighbouring environment.

"We have been able to see this phenomenon due to the long spin lifetime and extremely high spin density of Archer's carbon-based spin material. This really highlights how unique this carbon material is and opens the door to a range of exciting potential quantum applications, not just as qubits with the ^{12}CQ chip.

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"In conjunction with qubit readout being developed with Queen Mary University London, qubit control and the increased spin lifetime is a significant step toward our objective building a functional qubit for use in a quantum computer."

This work complements Archer's readout technology (the output of data from the quantum device), which leverages the quantum mechanical Coulomb Blockade phenomenon (ASX announcement 30 October 2024) and the increased spin lifetime of Archer's unique carbon film quantum material (ASX announcement 8 January 2025).

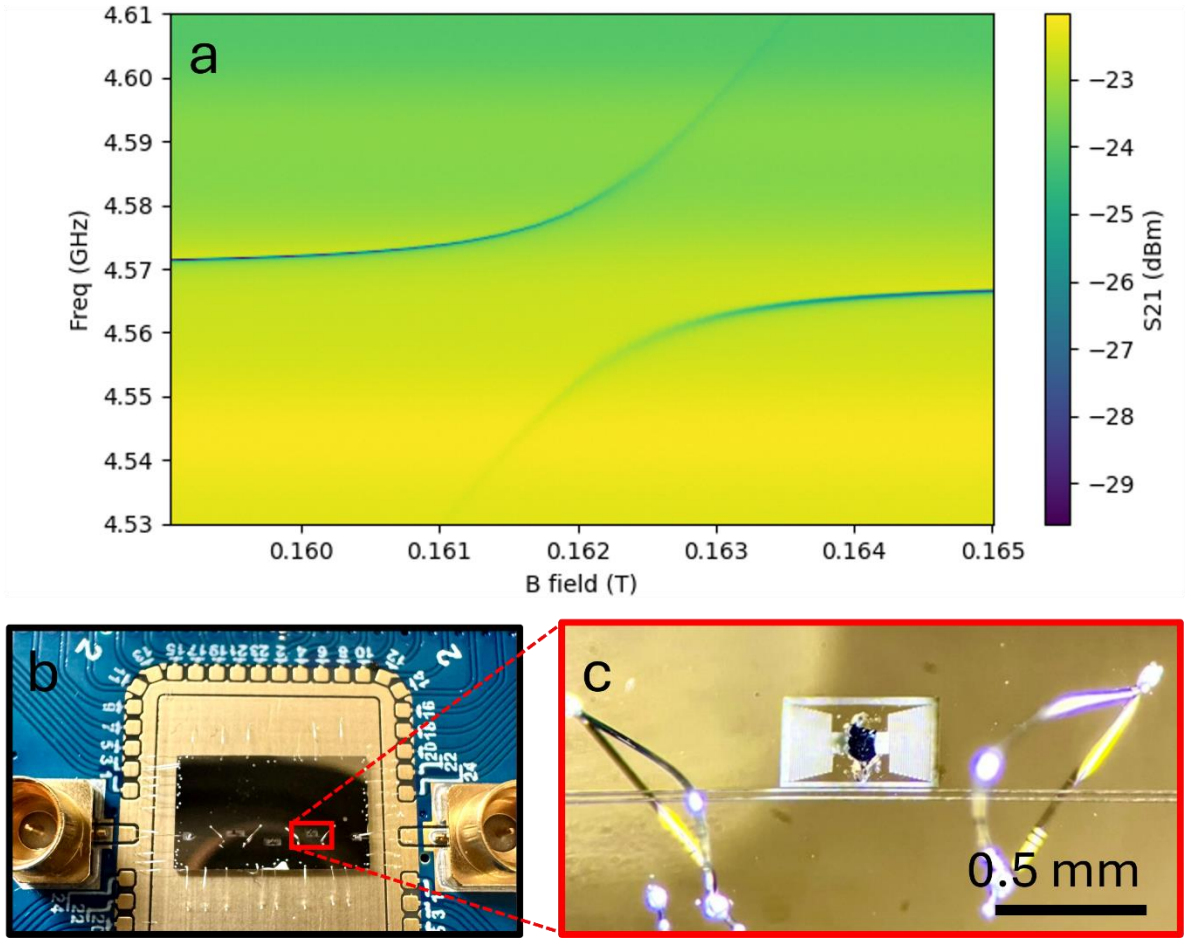

Image (a) Microwave measurements demonstrating the 'avoided crossing' effect caused by a quantum mechanical phenomenon where the spin states of Archers novel carbon spin material are hybridised with a resonator. This measurement is performed at a temperature of 30 millikelvin, which is below that which the resonator becomes superconducting. The unprecedented clarity this phenomenon is seen is due to the attractive spin properties of Archer's carbon-based spin material, verifying the uniqueness and advantage of using this material for a broad range of quantum applications. **Image (b)** The test resonator chip used for these microwave measurements. **Image (c)** Close-up image of one resonator with a small piece of Archer's carbon spin material placed over the spin sensing region of the chip.

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The Company intends to use this resonator design to deliver microwave pulses to accurately control individual qubits. This technique is an efficient way to precisely control a qubit, needed to be able to perform entangling and computation operation on a quantum computer.

The next stage of this project will be to develop our initial results to demonstrate readout and control feasibility by Q4 2025. Work can then proceed to combine the structures used for readout and control into a functional qubit, which is targeted for H1 2026

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

Investor enquiries

Howard Marks
+61 402 438 019
howard.marks@automicgroup.com.au

Media enquiries

Dylan Mark
+61 475 783 675
Dylan.mark@automicgroup.com.au

About Archer

Archer is a technology company that operates within the semiconductor industry. The Company is developing advanced semiconductor devices, including chips relevant to quantum computing, sensing, and medical diagnostics. Archer utilises its global partnerships to develop these technologies for potential deployment and use across multiple industries. www.archerx.com.au