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Chip build fast-tracked with qubit modelling

Highlights

- Computational models developed for the first time accurately predict Archer's ^{12}CQ qubit behaviour, necessary for successful chip operation.
- Quantum mechanical models validate Archer's ^{12}CQ technology global competitive advantage and open the way for streamlined development.
- Accurate simulations could strengthen and grow Archer's quantum computing patent portfolio in the near and long-term.
- Archer is well-funded to continue its ^{12}CQ chip technology development, with a key focus on demonstrating few and single-qubit control prototypes.

Archer Materials Limited ("Archer", the "Company", "ASX: **AXE**") is pleased to announce for the first time computational quantum mechanical theory has been developed that accurately models the behaviour of the qubit material at the core of Archer's ^{12}CQ quantum computing qubit processor ("chip"). The computational models validate the origins of experimentally observed quantum phenomena in the qubit material and allow the Company to predict future quantum behaviour. This achievement is fundamental to the successful development of the chip.

Commenting on the Company's recent achievement, Archer CEO Dr Mohammad Choucair said: "We are effectively deploying capital and resources to streamline our chip build. The computational modelling of Archer's qubit system is a world-first and provides a sound theoretical footing for the ^{12}CQ technology.

"In the global multibillion dollar quantum computing ecosystem this type of theoretical validation is a technological prerequisite and demonstrates that Archer operates under a high degree of certainty in its qubit chip development.

"We can now accurately predict the ^{12}CQ qubit materials' future behaviour, performance, and overcome potential limitations in device operation from an early stage, to drastically reduce technological risk and assist in moving forward with our partners."

World-first quantum theoretical validation

Archer is working with world-leading theoretical physicists at the prestigious research institute École Polytechnique Fédérale de Lausanne, Switzerland ("EPFL"), to computationally model Archer's unique qubit material. The results of the work validate Archer's global competitive advantage in quantum computing processor technology development.

For the first time, advanced computational modelling methods of Molecular Dynamics and Density Functional Theory were used to accurately simulate and confirm previous experimental observations made on Archer's qubit material (as represented in Image 1 for the first time).

The computational methods developed by Archer and EPFL are extremely complicated

There are very few people and institutions in the world that can do this type of work and the complexity and importance of this work to Archer's ^{12}CQ technology development cannot be overstated, as the greatest amount of value creation in the quantum computing economy is generated from technology development[†].

The qubit material models were derived from first principles and to the highest scientific standards internationally in the field of theoretical condensed matter physics (*i.e.* not obtained using simple analytical formulas found in spreadsheets or similar analysis software).

The derivation of the theoretical computational methods will allow Archer to validate, model, predict, and exploit the fundamental quantum properties of its unique qubit material in quantum computing and is essential in the development of an operational chip prototype.

The quantum information ("qubit") in Archer's chip design is in the form of an electron's quantum property of '*spin*', so it is critical to have developed accurate models predicting the electronic properties of the qubit material for the successful development of the ^{12}CQ chip.

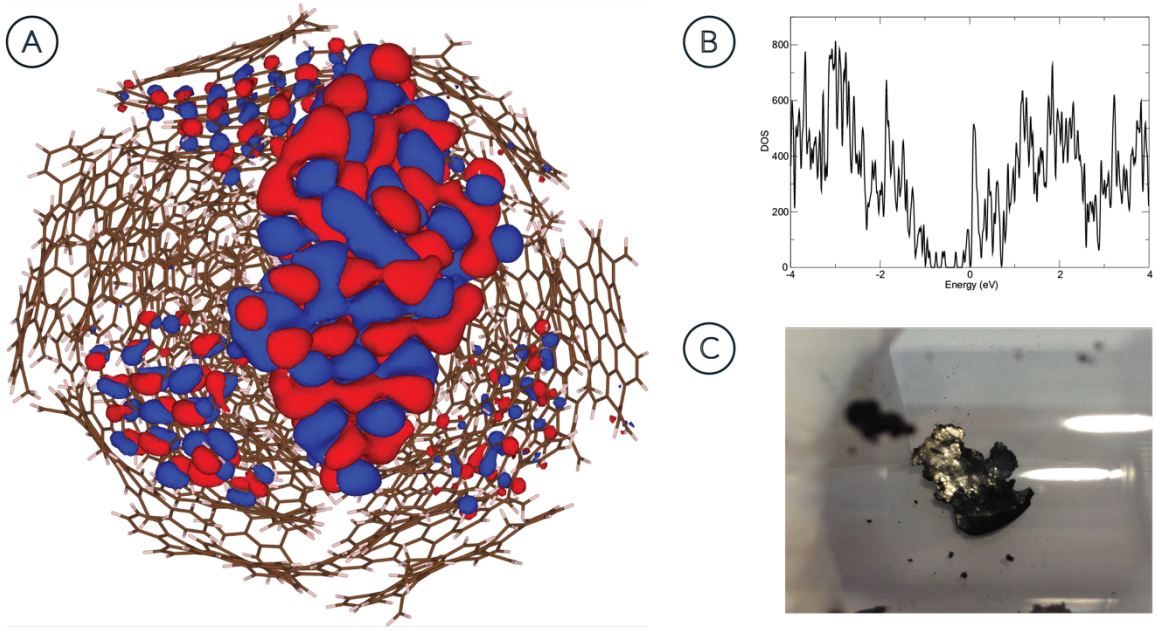

Image 1. The critical qubit material component in Archer's ^{12}CQ technology. ***A*** Part of the computational model developed that accurately represents the atom-scale structure of the nanosized qubit material, used for calculating the qubit materials' electronic properties for the first time including in ***B*** the density of states (DOS) confirming the unique metallic-like character of the material which in ***C*** can be seen in reality in bulk quantities of qubit material having a metallic shimmer. Properties theoretically determined in ***A*** and ***B*** validate R&D underpinning Archer's ^{12}CQ quantum computing technology[‡].

[†] https://www.bcg.com/en-au/publications/2019/quantum-computers-create-value-when
[‡] https://www.nature.com/articles/ncomms12232

Archer's development advances towards an operational qubit prototype

The computational modelling of Archer's ^{12}CQ qubit materials system forms a key part of the Company's technology development work package focused on qubit control (ASX Ann. 9 Jul 2020) which continues and is on track with the successful outcomes in this ASX release.

The models and methods could strengthen and grow Archer's quantum computing patent portfolio in areas related to future chip operation, e.g. rapid optimisation of the qubit material could allow for greater end-user applications.

The Company intends to prepare the results of the work for peer-reviewed scientific publication in an accredited journal to disseminate the technical aspects of the work, and key details of publication will be released to ASX.

About ^{12}CQ

^{12}CQ is a world-first technology that Archer aims to build for quantum computing operation at room-temperature and integration onboard modern electronic devices. For more information about Archer's chip technology, please view Archer's most recent webinar held with IBM.

About Archer

A materials technology company developing materials in quantum computing, biotechnology, and lithium-ion batteries, and exploring for minerals in Australia. The Company has strong intellectual property, broad-scope mineral tenements, world-class in-house expertise, a unique materials inventory, and access to over $300 million of technology development infrastructure.

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

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