

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

29 April 2024

Q3 FY24 Activities Report and Appendix 4C

For the quarter ended 31 March 2024.

Overview

- Archer Materials progressed its ¹²CQ quantum technology project by developing a pulsed electron spin resonance (p-ESR) chip with research partner EPFL.
 - The technical details of the p-ESR chip were made publicly available as an open-access pre-print scientific article and highlight the potential for the precision sensing technology in integrated and portable electronic devices.
 - Archer progressed its Biochip technology with a significant redesign of circuit layouts to miniaturise the graphene field effect transistor (gFET) chip design from 10 mm² to 1.5 mm².
 - The new Biochip designs were sent for fabrication at Applied Nanolayers, a foundry in the Netherlands, with plans for the produced wafers to be processed in Japan by Archer's newly established OSAT partner, AOI Electronics.
 - Delivery of the packaged miniature Biochip gFET chips is anticipated in mid-2024.
 - Strong cash position to fund activities with \$20.0 million and no debt.
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Archer Materials Limited ("Archer", the "Company", "ASX: AXE"), a semiconductor company advancing the quantum computing and medical diagnostics industries, provides its Quarterly Activities Report and Appendix 4C for the quarter ended 31 March 2024 ("Quarter").

Commenting on Q3 FY24 activities, Greg English, Executive Chairman of Archer, said

"During the Quarter, the Archer team significantly reduced the size of the Biochip by redesigning the circuit layout. The miniaturised chips will undergo wafer dicing, assembly, packaging, and electrical testing.

"The substantial reduction in the size of the Biochip was an outstanding achievement by our CEO, Dr Mohammad Choucair, and the Archer team.

"The Archer team progressed the ¹²CQ project by building a single chip integrated pulsed electron spin resonance ("p-ESR") chip capable of detecting and analysing materials for signs of electron spin manipulation. We developed the p-ESR chip in conjunction with EPFL, our Swiss-based research partner, which is a leader in this type of technology.

"We were able to progress the ¹²CQ and Biochip projects by continuing our strategy of partnering with overseas experts. European-based Applied Nanolayers and EPFL have the people, technology, and equipment that allow Archer to progress our project cost-effectively."

Technology development and commercialisation activities

¹²CQ chip

During the Quarter, Archer designed, developed, and built a single chip integrated pulsed electron spin resonance (“p-ESR”) microsystem, with its research partner École Polytechnique Fédérale de Lausanne (“EPFL”) in Switzerland.

Archer and EPFL intend to use the p-ESR microsystem to perform complex measurements involving the potential electron spin manipulation of Archer’s ¹²CQ quantum materials. The measurements will be ongoing throughout CY2024. The miniaturisation and electron spin sensitivity of the p-ESR microsystem also allows Archer to explore opportunities in developing quantum sensors, advanced spectrometers, and analytical devices.

The p-ESR microsystem is a tiny, integrated device designed to detect and analyse the behaviour of unpaired electrons, that potentially carry spin quantum information, in materials at a very small scale. It measures 0.7 mm² in size and it includes integrated circuit components like micro coils, amplifiers, filters, and mixers, all working together to detect and amplify signals related to the behaviour of unpaired electrons (Image 1). Significant innovation is required to design, develop, and build an operational p-ESR microsystem.

The p-ESR chip is manufactured using a 130 nm SiGe BiCMOS technology (IHP SG13G2Cu). This follows research and development by Archer and EPFL on detecting electron spins in its quantum materials using continuous wave ESR (“cw-ESR”) chips built with high electron mobility transistor (“HEMT”) and complementary metal-oxide semiconductor (“CMOS”) technology (ASX ann. 10 Oct 2022, 1 Feb 2022, and 20 Apr 2023). The new p-ESR chip technology is a significant advance over the HEMT and CMOS chips in both design and functionality.

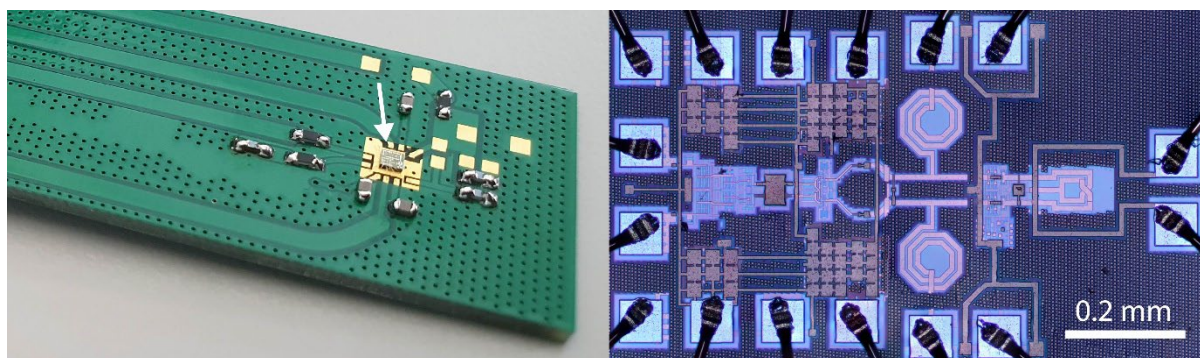


Image 1. (Left) The 0.7 mm² single chip integrated p-ESR, indicated by the arrow, which is glued on a printed circuit board and electronically connected by gold wire bonding. (Right) Photograph under magnification of the chip area showing some of the integrated micron sized components, including micro coils. The chip stands in contrast to traditional ESR instrument systems that often entail bulky and complex setups that require significant space and resources.

The technical details of the design, characterisation, and operation of the p-ESR chip were made publicly available as a pre-print scientific article in an open-access repository[†]. Archer filed an Australian provisional patent application related to the p-ESR chip.

[†] R. Farsi et al. X-band single chip integrated pulsed electron spin resonance microsystem. *ChemRxiv*, 26 March 2024. <https://doi.org/10.26434/chemrxiv-2024-0tvmv>

Archer's Biochip

Archer's biochip innovation aims to integrate graphene field effect transistors ("gFETs") into advanced fluidic systems to create miniaturised lab-on-a-chip device platforms for medical diagnostics. If successful, this could enable the ability to parallelise the detection of multiple biologically relevant targets on a chip.

The Archer Biochip contains a sensing region of which the gFET is the core component. Each gFET chip contains multiple gFETs, each of which is a transistor, which acts as a sensor. Archer has previously confirmed the fabrication and electrical conductivity of earlier generations of gFET chip designs by the manufacture of chips at semiconductor foundries in Europe.

The developments made during the Quarter follow Archer's progress on gFET chip designs for parallelised (multiplexed) sensing fabricated through four-inch wafer runs by Applied Nanolayers ("ANL"), a semiconductor foundry in the Netherlands. By developing various designs for Archer's Biochip gFET sensors, the Company can broaden its foundry network, improve quality control of its chips, and expand possible applications.

During the Quarter, Archer designed a miniaturised version of its Biochip gFET chip. The new miniaturised design was sent to ANL for a whole-wafer fabrication of reduced size gFET chips, which Archer intends to integrate with other parts of the Biochip technology. Archer has developed in-house expertise and know-how in gFET chip design with the significant reduction in size of the Biochip.

The new gFET chip design has been significantly reduced in size over earlier designs of 10 mm² to 1.5 mm². It will be tested on a four-inch wafer which is expected to produce 1375 chips on it, compared to the 45 chips produced using earlier designs in previous four-inch wafer fabrication runs. Archer miniaturised the total chip size by redesigning the layout of the circuits creating these gFET transistors.

Archer applies the 'fabless' chipmaker model by designing, researching, and developing its chips, while outsourcing manufacturing to specialised companies in the semiconductor supply chain. This includes the creation of a new miniaturised Biochip gFET chip design, sending the design for a whole wafer run in a commercial foundry, and deciding on the chip assembly and semiconductor device electronics packaging and related electrical testing.

Archer continues to strengthen its relationships with global semiconductor industry partners. The wafer produced by ANL will be diced and assembled at Archer's newly established outsourced semiconductor assembly and testing ("OSAT") partner, AOI Electronics in Japan. The OSAT includes moulding, dicing, and lead frame design for the dedicated assembly of the ANL produced wafer, and device electronic shorting and related packaging testing. Delivery of the packaged miniaturised chips is anticipated in mid-2024.

New capabilities are key in advancing the Biochip development to interfacing and integration with miniaturised gFET chip sensor designs. During the Quarter, Archer established a multidisciplinary laboratory at Cicada Innovations[‡], in Sydney, Australia. The Company outgrew its previous laboratory arrangements in the University of Sydney Hardware Lab. The new laboratory facility primarily supports Archer's R&D activities and includes capabilities for hardware testing and analysis, and materials chemistry and engineering.

[‡] <https://www.cicadainnovations.com/>

Financial and corporate update

The Company's cash balance at the end of the Quarter was \$20,010,000 with no debt. The Company holds 1,633,944 shares in Canadian Stock Exchange listed Volatus Capital Corp (CSE:VC) and 11,571,119 shares and 2,892,780 quoted options in ASX listed ChemX Materials Ltd (ASX:CMX).

Archer's accompanying Appendix 4C cashflow report for the Quarter includes an amount of \$142,000 at item 6.1, relating to executive and non-executive director fees paid as salaries and wages.

Events and outreach

Archer participated in the Sydney Quantum Academy Quantum Australia 2024 industry event. This event was attended by industry, academia, and government from Australia and internationally, that are active in quantum technology research and commercialisation, and it provided a valuable networking opportunity for Archer to explore potential partnerships to build on its access to technology development facilities and talent.



Archer also distributed Newsletters, including:

- March 2024: [Archer develops new p-ESR chip and miniaturises its Biochip gFETs](#)
- February 2024: [Archer attends Quantum Australia 2024 and adds to industry research](#)
- January 2024: [Archer adds to framework for the future quantum ecosystem](#)

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

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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 and medical diagnostics. www.archerx.com.au

Appendix 4C

Quarterly cash flow report for entities subject to Listing Rule 4.7B

Name of entity

Archer Materials Limited

ABN

64 123 993 233

Quarter ended ("current quarter")

31 March 2024

Consolidated statement of cash flows	Current quarter \$A'000	Year to date (9 months) \$A'000
1. Cash flows from operating activities		
1.1 Receipts from customers	-	-
1.2 Payments for		
(a) research and development (excludes wages allocated to R&D)	(179)	(1,354)
(b) product manufacturing and operating costs	-	-
(c) advertising and marketing	-	-
(d) leased assets	-	(32)
(e) staff costs	(968)	(2,829)
(f) administration and corporate costs	(397)	(1,357)
1.3 Dividends received (see note 3)	-	-
1.4 Interest received	86	965
1.5 Interest and other costs of finance paid	-	-
1.6 Income taxes paid	-	-
1.7 Government grants and tax incentives	-	1,456
1.8 Other (provide details if material)		
1.9 Net cash from / (used in) operating activities	(1,458)	(3,151)

2. Cash flows from investing activities		
2.1 Payments to acquire or for:		
(a) entities	-	-
(b) businesses	-	-
(c) property, plant and equipment	(62)	(86)
(d) investments		
(e) intellectual property	(32)	(70)

Consolidated statement of cash flows	Current quarter \$A'000	Year to date (9 months) \$A'000
(f) other non-current assets	-	-
2.2 Proceeds from disposal of:		
(a) entities	-	-
(b) businesses	-	-
(c) property, plant and equipment	-	-
(d) investments	-	-
(e) intellectual property	-	-
(f) other non-current assets	-	-
2.3 Cash flows from loans to other entities	-	-
2.4 Dividends received (see note 3)	-	-
2.5 Other (provide details if material)	-	-
2.6 Net cash from / (used in) investing activities	(94)	(156)

3. Cash flows from financing activities		
3.1 Proceeds from issues of equity securities (excluding convertible debt securities)	-	-
3.2 Proceeds from issue of convertible debt securities	-	-
3.3 Proceeds from exercise of options	-	-
3.4 Transaction costs related to issues of equity securities or convertible debt securities	-	-
3.5 Proceeds from borrowings	-	-
3.6 Repayment of borrowings	-	-
3.7 Transaction costs related to loans and borrowings	-	-
3.8 Dividends paid	-	-
3.9 Other (provide details if material)	-	-
3.10 Net cash from / (used in) financing activities	-	-

4. Net increase / (decrease) in cash and cash equivalents for the period		
4.1 Cash and cash equivalents at beginning of period	21,562	23,317
4.2 Net cash from / (used in) operating activities (item 1.9 above)	(1,458)	(3,151)
4.3 Net cash from / (used in) investing activities (item 2.6 above)	(94)	(156)

Consolidated statement of cash flows		Current quarter \$A'000	Year to date (9 months) \$A'000
4.4	Net cash from / (used in) financing activities (item 3.10 above)	-	-
4.5	Effect of movement in exchange rates on cash held	-	-
4.6	Cash and cash equivalents at end of period	20,010	20,010

5.	Reconciliation of cash and cash equivalents at the end of the quarter (as shown in the consolidated statement of cash flows) to the related items in the accounts	Current quarter \$A'000	Previous quarter \$A'000
5.1	Bank balances	339	491
5.2	Call deposits	19,671	21,071
5.3	Bank overdrafts	-	-
5.4	Other (provide details)	-	-
5.5	Cash and cash equivalents at end of quarter (should equal item 4.6 above)	20,010	21,562

6.	Payments to related parties of the entity and their associates	Current quarter \$A'000
6.1	Aggregate amount of payments to related parties and their associates included in item 1 * The above payments relate to fees and salaries paid to Directors during the quarter.	142
6.2	Aggregate amount of payments to related parties and their associates included in item 2	-
<i>Note: if any amounts are shown in items 6.1 or 6.2, your quarterly activity report must include a description of, and an explanation for, such payments.</i>		

7. Financing facilities <i>Note: the term "facility" includes all forms of financing arrangements available to the entity. Add notes as necessary for an understanding of the sources of finance available to the entity.</i>	Total facility amount at quarter end \$A'000	Amount drawn at quarter end \$A'000
7.1 Loan facilities	-	-
7.2 Credit standby arrangements	-	-
7.3 Other (please specify)	-	-
7.4 Total financing facilities	-	-
7.5 Unused financing facilities available at quarter end		n/a
7.6 Include in the box below a description of each facility above, including the lender, interest rate, maturity date and whether it is secured or unsecured. If any additional financing facilities have been entered into or are proposed to be entered into after quarter end, include a note providing details of those facilities as well.	n/a	

8. Estimated cash available for future operating activities	\$A'000
8.1 Net cash from / (used in) operating activities (item 1.9)	(1,458)
8.2 Cash and cash equivalents at quarter end (item 4.6)	20,010
8.3 Unused finance facilities available at quarter end (item 7.5)	-
8.4 Total available funding (item 8.2 + item 8.3)	20,010
8.5 Estimated quarters of funding available (item 8.4 divided by item 8.1)	13.7
<i>Note: if the entity has reported positive net operating cash flows in item 1.9, answer item 8.5 as "N/A". Otherwise, a figure for the estimated quarters of funding available must be included in item 8.5.</i>	
8.6 If item 8.5 is less than 2 quarters, please provide answers to the following questions:	
8.6.1 Does the entity expect that it will continue to have the current level of net operating cash flows for the time being and, if not, why not?	
Answer: n/a	
8.6.2 Has the entity taken any steps, or does it propose to take any steps, to raise further cash to fund its operations and, if so, what are those steps and how likely does it believe that they will be successful?	
Answer: n/a	
8.6.3 Does the entity expect to be able to continue its operations and to meet its business objectives and, if so, on what basis?	
Answer: n/a	
<i>Note: where item 8.5 is less than 2 quarters, all of questions 8.6.1, 8.6.2 and 8.6.3 above must be answered.</i>	

Compliance statement

- 1 This statement has been prepared in accordance with accounting standards and policies which comply with Listing Rule 19.11A.
- 2 This statement gives a true and fair view of the matters disclosed.

Date: 29 April 2024.....

Authorised by: By the Board.....
(Name of body or officer authorising release – see note 4)

Notes

1. This quarterly cash flow report and the accompanying activity report provide a basis for informing the market about the entity's activities for the past quarter, how they have been financed and the effect this has had on its cash position. An entity that wishes to disclose additional information over and above the minimum required under the Listing Rules is encouraged to do so.
2. If this quarterly cash flow report has been prepared in accordance with Australian Accounting Standards, the definitions in, and provisions of, *AASB 107: Statement of Cash Flows* apply to this report. If this quarterly cash flow report has been prepared in accordance with other accounting standards agreed by ASX pursuant to Listing Rule 19.11A, the corresponding equivalent standard applies to this report.
3. Dividends received may be classified either as cash flows from operating activities or cash flows from investing activities, depending on the accounting policy of the entity.
4. If this report has been authorised for release to the market by your board of directors, you can insert here: "By the board". If it has been authorised for release to the market by a committee of your board of directors, you can insert here: "By the [name of board committee – eg Audit and Risk Committee]". If it has been authorised for release to the market by a disclosure committee, you can insert here: "By the Disclosure Committee".
5. If this report has been authorised for release to the market by your board of directors and you wish to hold yourself out as complying with recommendation 4.2 of the ASX Corporate Governance Council's *Corporate Governance Principles and Recommendations*, the board should have received a declaration from its CEO and CFO that, in their opinion, the financial records of the entity have been properly maintained, that this report complies with the appropriate accounting standards and gives a true and fair view of the cash flows of the entity, and that their opinion has been formed on the basis of a sound system of risk management and internal control which is operating effectively.