

# ARCHER

Advanced Materials Business Update & Presentation  
September 2018

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*“We are providing shareholders exposure to innovative technologies like quantum computing, and the advanced materials that underpin them.”*

*Archer CEO, Dr Mohammad Choucair FRACI MRSN*

A close-up photograph of two black microscope eyepieces. The lenses are visible, showing a greenish reflection. The background is blurred, showing parts of the microscope's body. A semi-transparent white diagonal shape is overlaid on the left side of the image.

# Corporate Snapshot



**Executive Chairman**  
 Greg English  
*LLB, BE (Mining)*



**Non-Executive Director**  
 Alice McCleary  
*DUniv, BEc FCA FTIA FAICD*



**Non-Executive Director**  
 Paul Rix  
*B.Com FAICD*



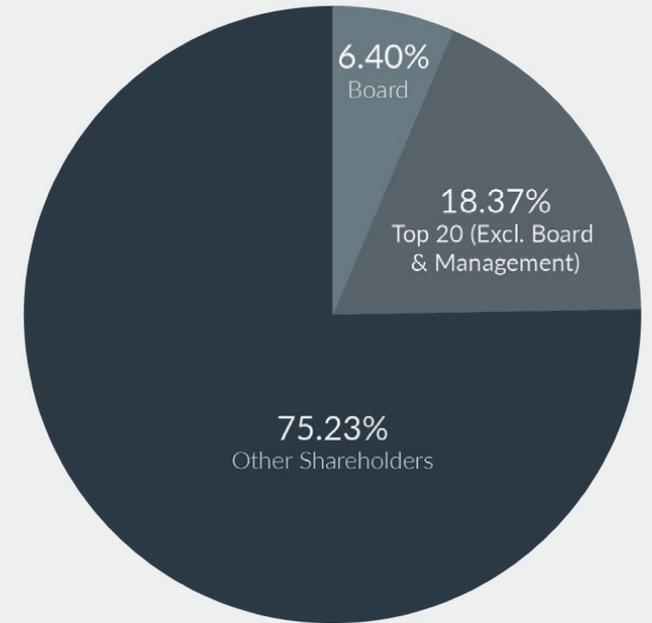
**Chief Executive Officer**  
 Mohammad Choucair  
*PhD, FRACI MRSN*



**Chief Financial Officer &  
 Company Secretary**  
 Damien Connor  
*CA GAICD AGIA B.Com*

**ASX Code: AXE**

<i>Incorporation</i>	<i>Australia</i>
<i>Ordinary shares</i>	<i>188.3m</i>
<i>Unlisted Options</i>	<i>13.28m</i>
<i>Performance Rights</i>	<i>4.2m</i>
<i>Market Cap (@\$0.08)</i>	<i>A\$15.1m</i>
<i>Cash (30 June 2018)</i>	<i>A\$2.75m</i>
<i>Founded in (Year)</i>	<i>2007</i>



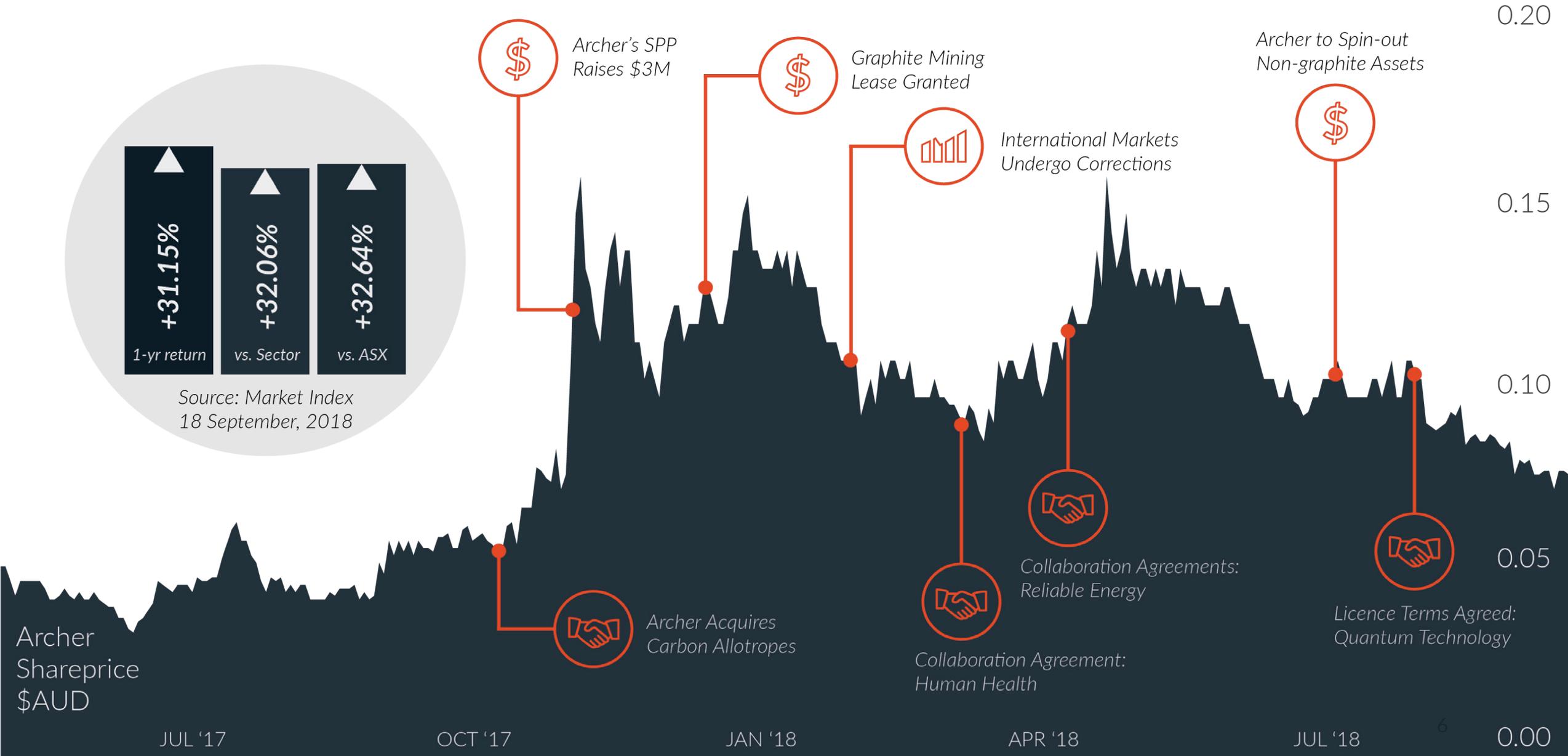
\$5M

\$10M

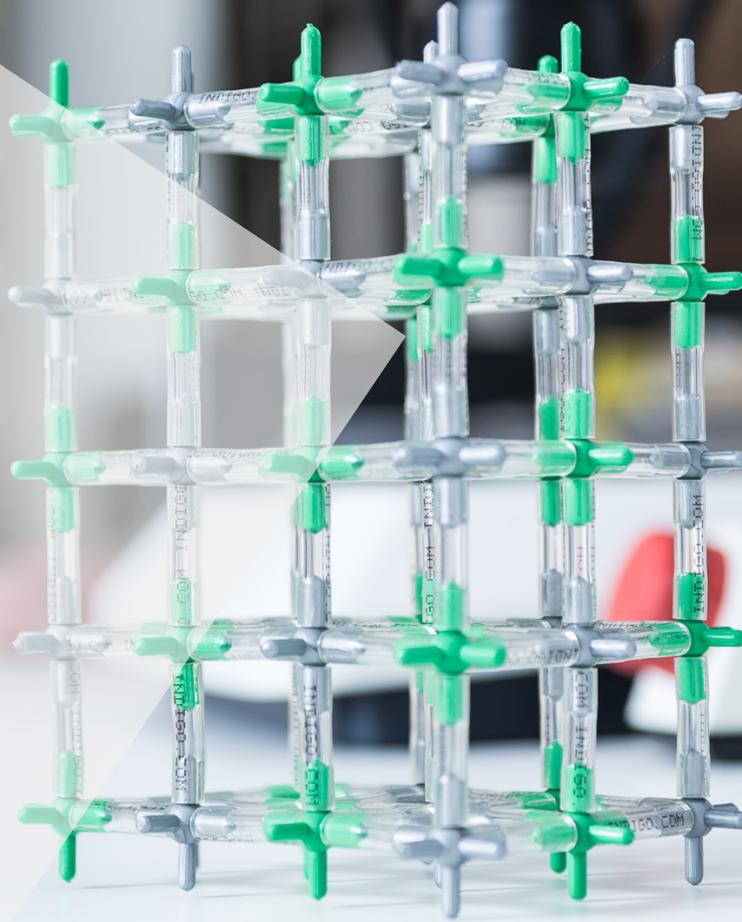
\$20M

\$28M

# Market Cap Milestones



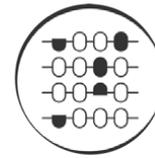
# Growth Strategy



# Since the acquisition of Carbon Allotropes and granting of the graphite mining lease, we have been rigorously executing a focused strategy for growth in key technology markets.

The Board, senior executives, and employees have been devoted to driving Archer forward effectively and with purpose to deliver shareholder value<sup>†</sup>.

Our focus on developing end-to-end material centric solutions has resulted in the identification of key advanced materials markets to strengthen and grow Archer. Our integrated approach to the materials life cycle is spawning high-value opportunities through our graphite and graphene assets, and wholly owned subsidiary Carbon Allotropes ([www.carbonallotropes.com](http://www.carbonallotropes.com)).



*Quantum Technology.* Quantum computing  
US\$11 billion market by 2024<sup>3</sup>  
Demand: Computing Power



*Reliable Energy.* Li-ion batteries  
US\$130 billion market by 2028<sup>1</sup>  
Demand: The Environment



*Human Health.* Biosensors  
US\$27 billion market by 2022<sup>2</sup>  
Demand: Ageing Populations

<sup>†</sup> Stockhead Top 100 best performing ASX small caps in FY18.

1. IDTechEx, 2017, Li-ion Batteries 2018-2028
2. Markets and Markets, 2017, Biosensors Market by Application - Global Forecast to 2022
3. Industry 40 Market Research, 2018, Quantum Computing Market & Technologies - 2018-2024



# Looking ahead, we are focused on delivering high-value outcomes that position Archer for major, long-term growth.

## 1 Quantum Technology

-  Finalise exclusive quantum technology IP licence with the University of Sydney
-  Execute collaboration and research service agreements for quantum technology IP
-  Finalise commercial plan for quantum technology IP with key partners

## 2 Reliable Energy

-  Co-develop IP to reduce costs related to graphite project
-  Lodge program for environment protection and rehabilitation (PEPR) for graphite project
-  Identify off-take partners for high-volume graphite supply
-  Grow the Carbon Allotropes Marketplace

## 3 Human Health

-  Enter into negotiations for biosensing related IP with a reputable institute
-  Partner with an industry collaborator to develop key biosensing componentry
-  Apply for grants and funding to support a commercial pathway to biosensor product development

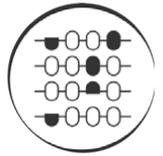


 Acquisitions & Partnerships

 Value-add Development

 Commercialisation

# Significant Developments in March – September 2018



## Quantum Technology

-  Archer enters exclusive negotiations for quantum technology IP
-  Key licence terms for quantum technology IP finalised, and facilitate filing of IP in EU, Australia, US, Japan, Korea, and China



## Reliable Energy

-  Campoona graphite structurally near perfect at atomic-scale
-  MOU with Urbix Resources for graphite toll processing
-  Collaboration agreements with FlexeGRAPH, and UNSW
-  Full-cell Li-ion batteries produced with Campoona graphite in-line with industry state-of-art



## Human Health

-  Collaboration agreement with ARC Graphene Hub redefined to focus on carbon-based biosensors
-  Campoona graphite is process agnostic in graphene production
-  Graphene inks prepared from Campoona graphite used for printed biosensing technologies

# Advanced Materials

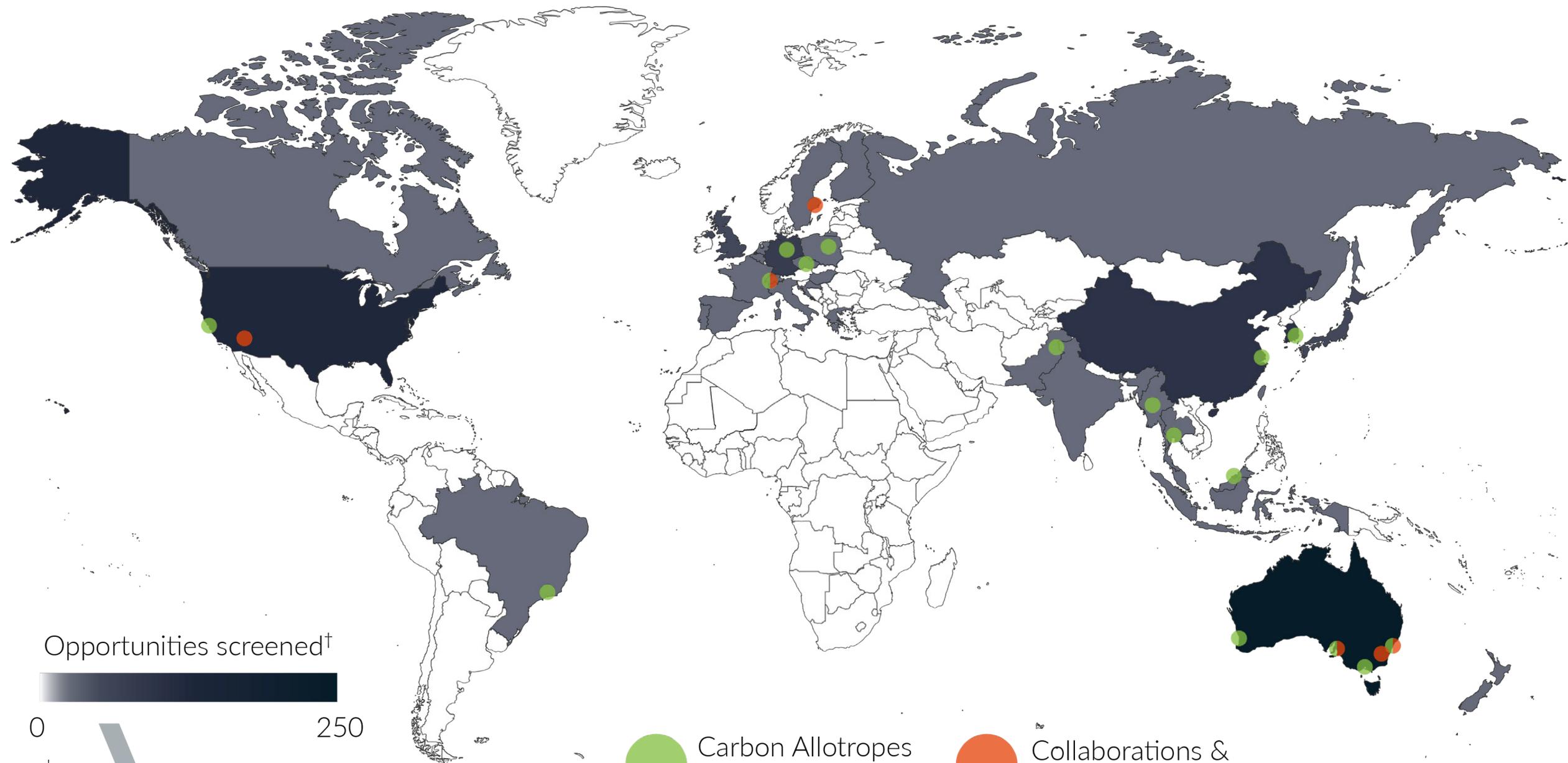
A laboratory scene featuring a person in a white lab coat and blue gloves. The person is using a mortar and pestle to grind a white powder. Three beakers containing liquids of different colors (blue, green, and red) are visible on the table. The text "Advanced Materials" is overlaid on the image.



UNSW Scientist preparing carbon electrodes with materials from Carbon Allotropes' inventory.

**Archer's growth involves connecting and contributing to complex global challenges.** These challenges require access to materials that are the basis of modern electricity, healthcare, and computing. Both developed and underdeveloped markets' needs are underpinned by advances in technology and the paradigm shifts that accompany them. Archer is uniquely positioning to meet these needs through its advanced materials business.

**The acquisition of Carbon Allotropes in late 2017,** spearheaded Archer's global reach through the marketplace platform. This brought to Archer world-class expertise, a diverse advanced materials inventory, and access to over \$100M in product research and development infrastructure. This has allowed us to rapidly identify, evaluate and respond to market opportunities for acquisitions, partnerships, and growth.



Opportunities screened<sup>†</sup>



0 250

<sup>†</sup>Includes potential partnerships, offtake, licencing and sales.



Carbon Allotropes Customers



Collaborations & Partnerships



# Quantum Technology



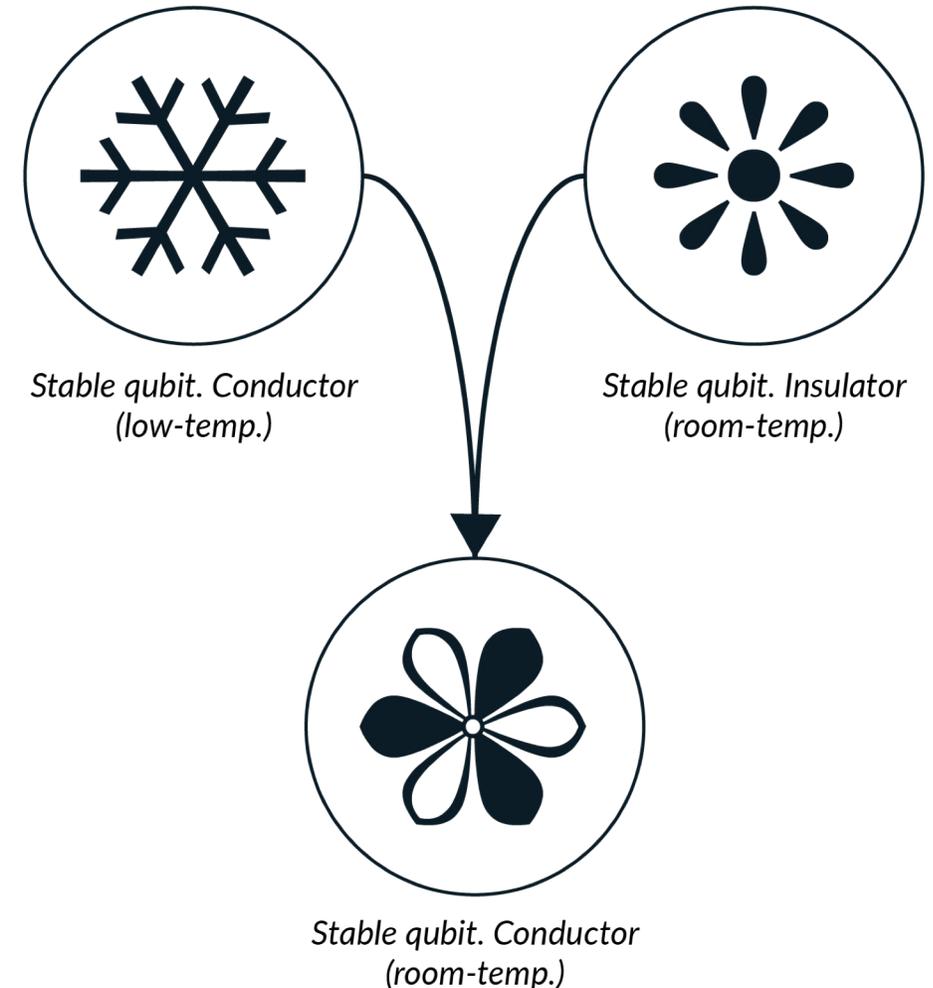
# A CARBON-BASED QUBIT PROCESSOR

## Quantum computers

represent the next generation of powerful computing<sup>4</sup>. They consist of a core device (chip) made from materials capable of processing quantum information (qubits) necessary to solve complex calculations<sup>5</sup>. One of the biggest challenges to wide-spread use involves keeping the qubit stable at room-temperature while integrating into electronic componentry. The development of quantum computers and technology is envisioned to impact all industries reliant on computational power, including financial modelling, cryptography and new currencies, and AI.

## Unifying the materials dichotomy

During his previous employment at the University of Sydney, Archer CEO Dr Mohammad Choucair invented the first material known to overcome both the limitations of sub-zero operating temperatures *and* electronic device integration for qubits. The conducting carbon material was able to process qubits at room temperature<sup>6</sup>. This has the potential to reduce the commercial barriers to quantum computing and make it globally accessible. The patented device forms the subject of intellectual property licencing being negotiated between Archer and the University of Sydney.



4. M. Russo, A. Thaker, S. Adam, BCG Henderson Institute, The Coming Quantum Lead in Computing (2018).

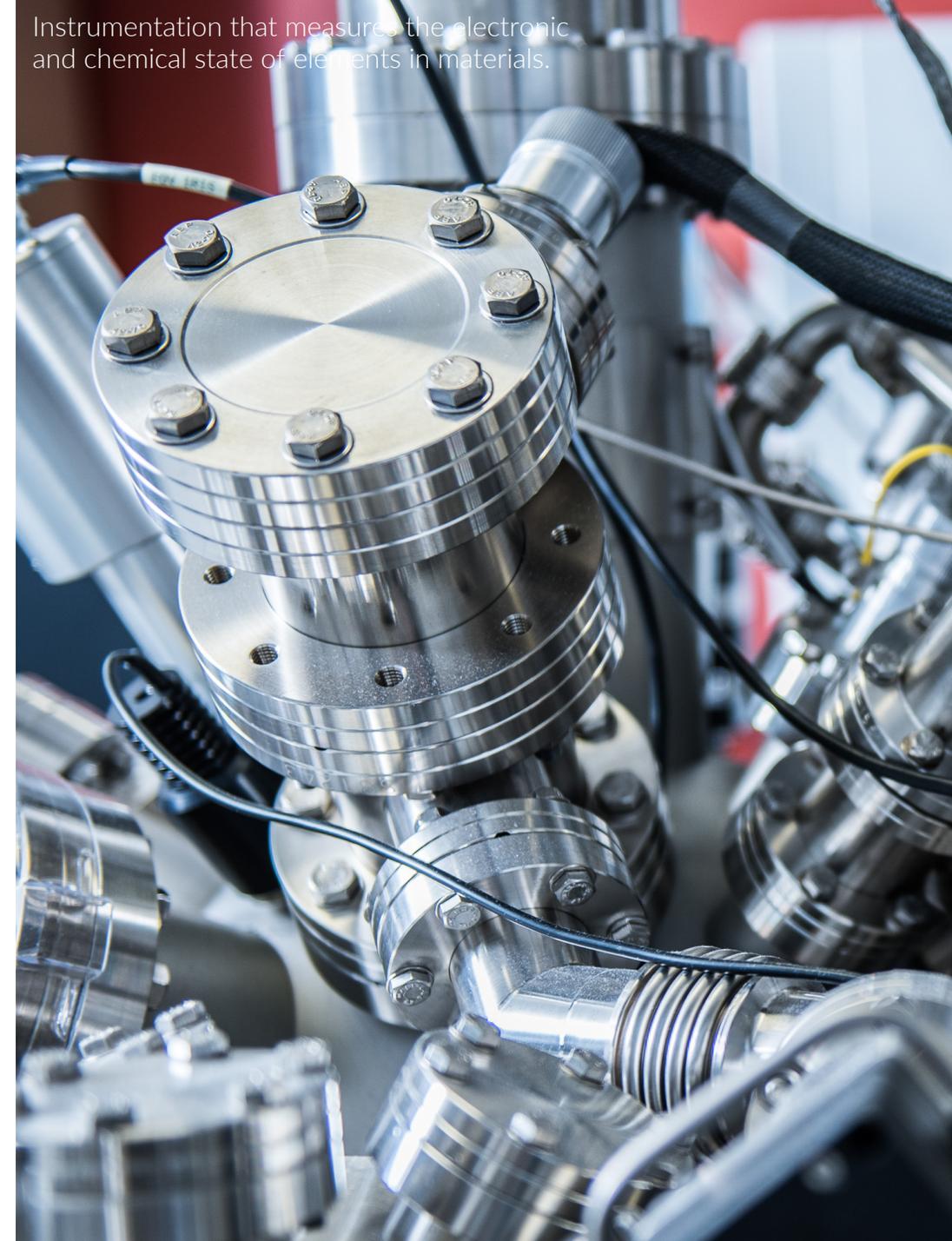
5. M. Jackson, Singularity Hub, 6 Things Quantum Computers Will Be Incredibly Useful For (2017).

6. M. Choucair et al. Nature Communications volume 7, Article number: 12232 (2016).

Instrumentation that measures the electronic and chemical state of elements in materials.

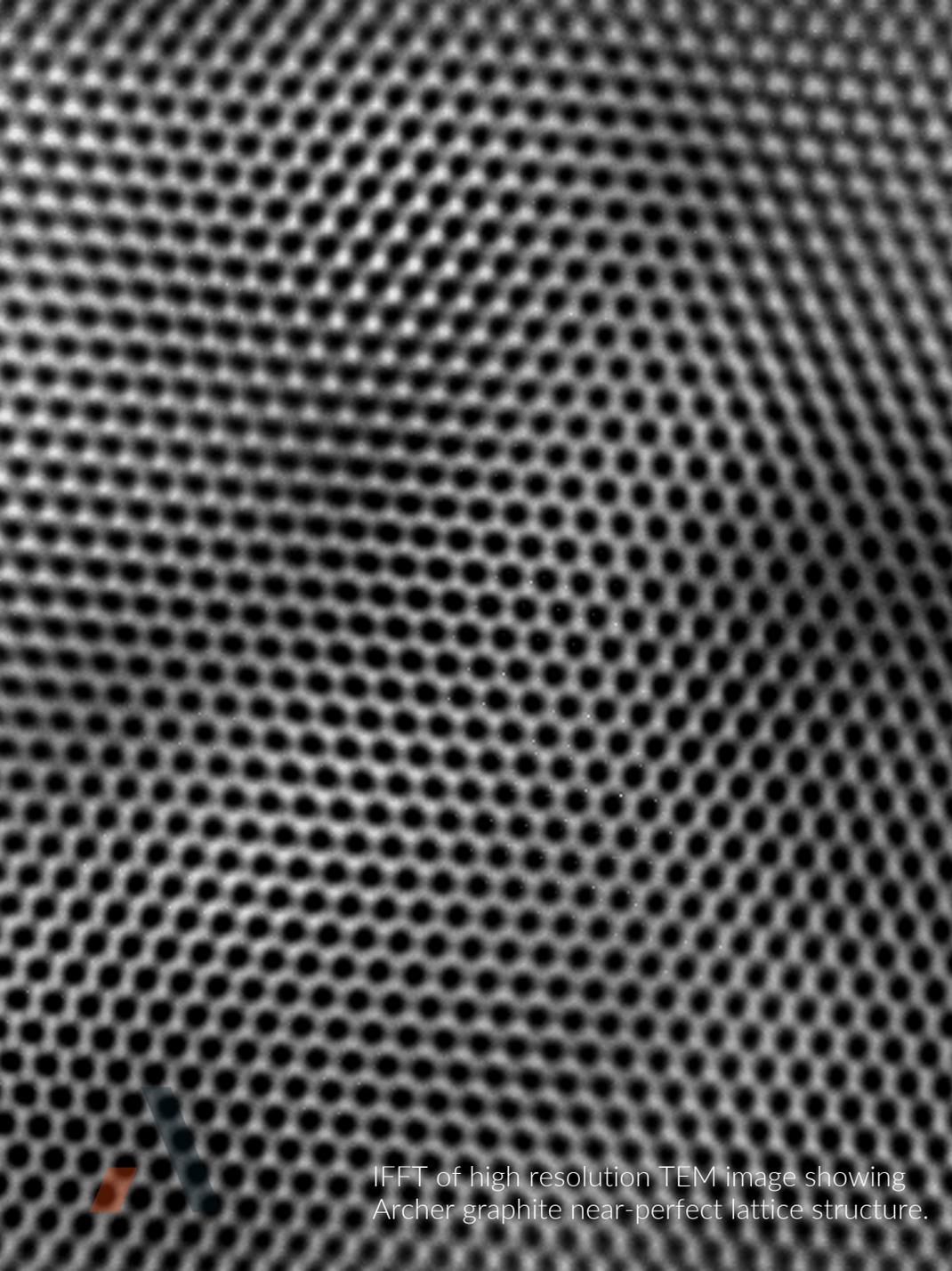
**Key licence terms for quantum technology intellectual property (IP) were finalised with the University of Sydney.** The licence terms would allow Archer to develop and commercialise carbon-based quantum computing technology. When executed, the licence will provide us with patents to develop and commercially exploit the quantum computing technology in Europe, America and Australasia.

**The IP relates to the development of a quantum electronic device (QED)** for storing and processing quantum bits (qubits) – the fundamental components of a quantum computer. In particular, the QED comprises advanced carbon material components critical for its function, including graphene, which are available in the inventory of Archer’s wholly owned subsidiary, Carbon Allotropes.





# Reliable Energy



IFFT of high resolution TEM image showing Archer graphite near-perfect lattice structure.

**We are capable of producing high quality graphite from our Campoona deposit.** Nano-scale and atomic-scale analysis was undertaken by Archer at the world-class Australian Centre for Microscopy & Microanalysis. The analysis of Archer's graphite confirmed the materials' near-perfect structure. These excellent results have greatly assisted in marketing our material to potential customers and end users.

**An MOU with Urbix Resources, LLC (Urbix)** was reached for investigating the suitability of Archer's Campoona graphite using Urbix's proprietary purification processes. The work led to an opportunity to toll-process Archer graphite in North America to grades in-line with HF leaching methods. This represents a potential capital cost benefit of \$14M over the life of the Campoona graphite project.

### **The collaboration agreement with FlexeGRAPH**

represents an opportunity to convert our high-volume Campoona graphite to high-value graphene materials. We agreed to co-develop advanced materials for the thermal management of electric vehicle batteries, internal combustion engines, and high-performance computing systems and to have these products sold through the Carbon Allotropes marketplace.

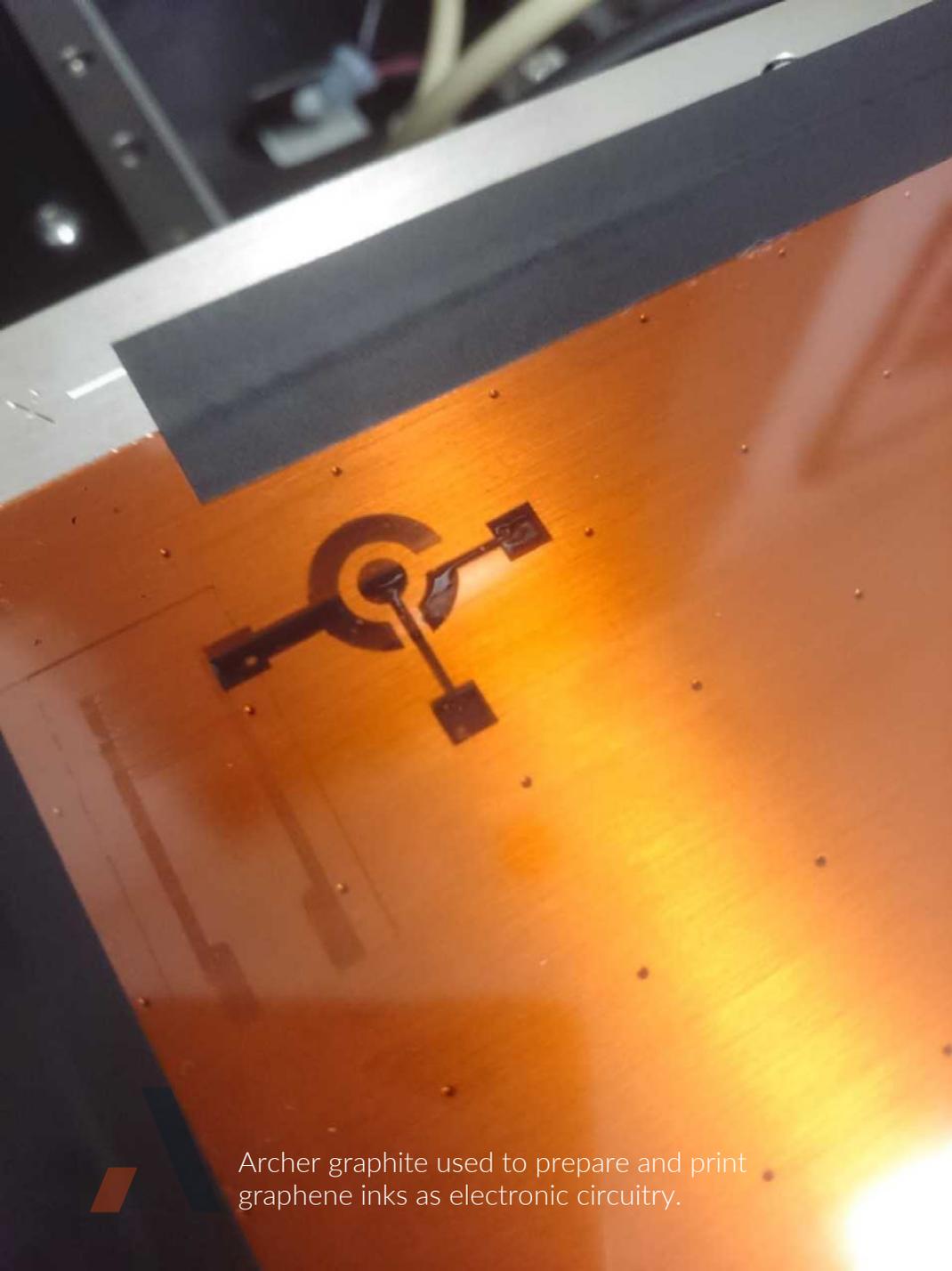
**We signed a collaboration agreement and research service agreement with The University of New South Wales.** The collaboration has led to the successful implementation of commercially scalable full-cell configuration lithium-ion batteries using Archer's Campoona graphite. We are now able to demonstrate complete, functioning, and commercially relevant batteries with Archer's graphite.

Archer graphite product used to prepare coin-cell scale full-cell batteries at UNSW.



A young man with short brown hair, wearing safety glasses and a white lab coat, is focused on looking through a white Leica M165 C microscope. The microscope is mounted on a stand and has a red warning label that reads "Scope Instrument Services" with contact information. The background shows a laboratory environment with a window featuring a decorative pattern. The text "Human Health" is overlaid in a large, bold, dark blue font on the left side of the image.

# Human Health



Archer graphite used to prepare and print graphene inks as electronic circuitry.

**The existing collaboration agreement with The University of Adelaide ARC Graphene Hub was varied.** This was the first of our targeted efforts to capture solutions with Archer's graphite and graphene materials. The effort would see graphene and carbon-based materials developed for use in complex biosensing, directly aligning with Archer's vision to target applications in human health.

**Graphene-based conductive inks** derived from Archer's Campoona graphite have since been developed with The University of Adelaide ARC Graphene Hub, using a combination of publicly available and propriety methods. The inks took advantage of Archer's materials' properties, and were used to print electronic circuits on transparent and flexible substrates that function as basic bio-electrochemical sensing device componentry.

A person wearing a white lab coat and safety glasses is holding a small, white, rectangular object, possibly a microplate or a sample, in a laboratory setting. The background shows a laboratory bench with various equipment, including a robotic arm and a microscope. The text "The Path Forward" is overlaid on the image in a large, bold, black font.

# The Path Forward

1



## Quantum Technology

Lead the development and commercialisation of carbon-based quantum technology. Reduce the commercial barriers to wide-spread quantum computing by building a practical qubit processor.

2



## Reliable Energy

Build an operational graphite mine in Australia. Target off-take & partnerships with lithium-ion battery manufacturers by scaling and integrating our Campoona graphite resource downstream in the supply chain.

3



## Human Health

Make complex biosensing simple. Service niche segments of the global biosensor market by developing commercially viable probes for rapid diagnostic medical imaging and disease detection.



UNSW Scientist formulating battery materials chemistries for testing with Archer graphite.



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