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Progress towards graphene biosensors for disease detection

Highlights

- Portable hardware developed to interface with Archer's biosensor technology with simplified sensor response.
- Formulation and successful testing of inkjet-printable, water-based antigen inks that increases the types of diseases that could be detected.
- Computational chemistry simulations are ongoing to efficiently predict detection mechanisms for specific diseases for greater device accuracy.
- Commercialisation in the multibillion-dollar biosensor industry involves high potential value asset, premarket, and market related transactions.
- Archer owns all the intellectual property rights protecting the biosensor technology, including a PCT application undergoing prosecution.

Archer Materials Limited ("Archer", the "Company", "ASX: **AXE**") is pleased to announce its recent developments in progressing the Company's graphene-based biosensor technology, which spans technology development, commercialisation and patent prosecution.

Commenting on the Company's biosensor development, Archer CEO Dr Mohammad Choucair said: "There is no doubt that diseases have a devastating effect on economies and there is value in advancing disease diagnosis using simpler, more accurate biosensors. However, there are only a limited number of materials that can perform this [biosensing], and they require innovative development.

"We have rapidly advanced from raw material feedstock to prototypes of a portable battery powered sensing device that can incorporate biological material. This early stage work has the potential to allow much simpler and more effective sensing where early diagnosis of life-threatening diseases can lead to much improved outcomes." Dr Choucair concluded.

Technology Advances

A number of achievements have been made recently that relate to the biosensing interface, data processing, and design and fabrication of materials electrodes critical to the biosensor technology function (Image 1). This has led to the design, testing and fabrication of early-stage portable battery powered prototypes employing an electronic interface for biosensing, which circumvents the need for cumbersome instrumentation and allows for point of use application.

A set of new graphene materials has been developed by Archer that could be directly applied for enhanced biosensing and their processing into biocompatible inks in water-based solvents,

eliminating the use of hazardous and non-biocompatible chemicals, increasing the scope of biomolecules that can be detected. Laboratory synthesis was complemented with computational chemistry to calculate and visualise these materials candidates at the atom-level for their suitability in biomolecular sensing.

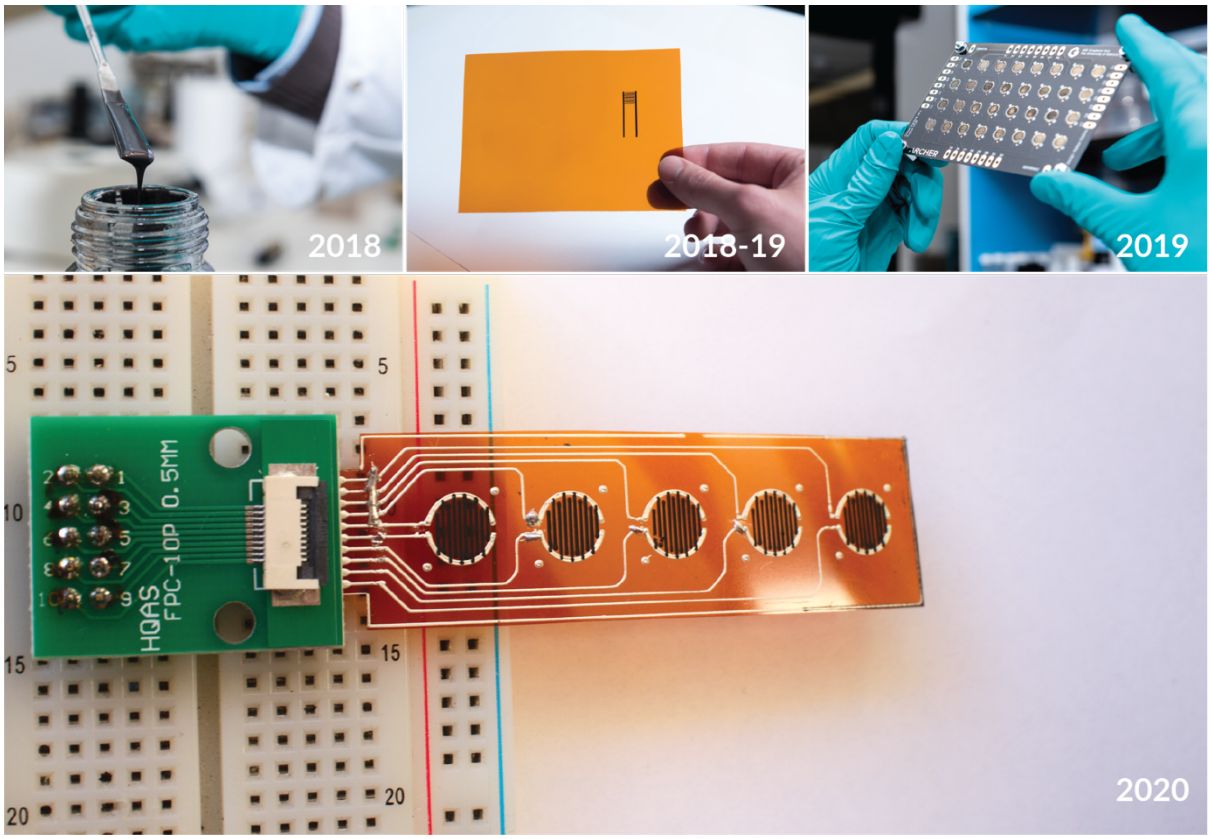

Image 1. Progress in the Company's graphene-based biosensor technology development. In 2018-2019 the Company focused on raw materials feedstock conversion to graphene and related inks that produce competitive advantages in biosensing. In 2019-2020, the technology componentry has evolved into prototypes of portable, battery powered, biosensing devices a few centimetres in size. The devices can incorporate flexible transparent substrates (orange), and inks made from graphene and biomaterials that can be patterned on the substrates for sensing (black interdigitated electrodes, that are the thickness of a few human hairs).

Commercial Readiness

Archer's graphene-based biotechnology is at an early stage of commercialisation. The Company engaged with independent technical and commercial advisors ("Advisors") within the Australian biotechnology industry to produce a comprehensive strategic commercialisation roadmap ("Roadmap") for Archer's graphene-based biosensor technology. The Roadmap remains commercial-in-confidence.

The independent research conducted by the Advisors indicates that within the multibillion-dollar biosensing industry, commercial transactions in the 5-year period between Jan 2014 to Dec 2019 related to diagnostics in development (i.e. not marketed):

+ the average acquisition value of disclosed terms exceeded US$100 million; and

+ of the 100+ partnerships and asset purchases, disclosures that were made indicated average transactions of US$20 million+.

Due to the long-term time frames associated with diagnostic deep tech development, later stage (and derisked) diagnostic technology (i.e. in-market) attracted larger size commercial transactions, with the average disclosed value from 50+ transactions, exceeding US$600 million. There were 450+ publicly announced partnerships and asset purchases, where average transactions exceeded US$230 million.

Value in the biosensor industry is primarily generated through the development of disruptive technology, strong portfolios of intellectual property, and access/ownership of technology infrastructure. Examples of companies involved in biosensor related corporate transactions include Johnson & Johnson (NYSE: JNJ), Roche (SWX: RO), and General Electric (NYSE: GE).

Intellectual Property

The Company maintains 100% ownership of a patent application filed under the Patent Cooperation Treaty ("PCT") to protect and commercialise intellectual property associated to the graphene-based biosensor materials technology. The International Search Report and Opinion of the International Searching Authority has now been received and is currently under review. The PCT continues to progress and is currently in the International Phase in the patent granting procedure, which is the first of two main phases, the second being the National Phase[†].

Next Steps

Archer's commercial strategy involves applying the triple-helix business model for biotechnology innovation to develop printable graphene-based biosensor componentry and sublicense the associated intellectual property rights by:

+ Developing commercial prototype *in-vitro* diagnostic biosensing devices by assembling and testing proprietary graphene-based componentry capable of enabling rapid multi-disease detection and device integration.

+ Prosecuting strong patent applications in Australia, the US and EU and to protect the intellectual property rights to the biosensor technology.

+ Establishing commercial partnerships with highly resourced organisations in the biotechnology industry with existing global distribution channels.

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.

[†] https://www.wipo.int/export/sites/www/pct/guide/en/gdvol2/pdf/gdvol2.pdf

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

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