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ASX Announcement (ASX:**AXE**) 30 July 2018

# Graphene inks for printed biosensor technologies

## Highlights

- Collaboration with The University of Adelaide ARC Graphene Hub has led to the development of graphene-based conductive inks derived from Archer's Campoona graphite, using a combination of publicly available and propriety methods.
- The methods to prepare the graphene inks take advantage of the exceptional structural and chemical properties of Archer's Campoona graphite that enable compatibility with print processing.
- The graphene inks produced were used to print electronic circuits on transparent and flexible substrates that exceed the minimum function thresholds necessary for basic electrochemical sensing device componentry targeting the area of human health.
- Graphene inks and printed graphene electronic device products form part of the emerging US$2 billion conductive ink technologies market[1] that is set to service niche segments of the global biosensor market expected to grow to US$27 billion by 2022[2].
- The results of the work will now be used to secure intellectual property rights to commercially viable technology integrating printed graphene componentry for biosensing devices.

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Archer Exploration Limited (ASX:AXE, Archer) is pleased to announce the following results of the collaboration between Archer and The University of Adelaide as part of the Australian Research Council Research Hub for Graphene Enabled Industry Transformation related to the development of a electrochemical graphene-based biosensor.

Graphene inks were prepared using a combination of established, publically available methods and proprietary methods that took advantage of the superior physical and chemical properties of Archer's Campoona graphite. Two printing techniques were employed using an inkjet

printer and a laser-scribed printer for the preparation of basic electrode patterns (Fig. 1). The electrochemical characteristics of the printed electrodes were obtained and proved adequate for biosensing device application. The rheological properties of inks are yet to be tested and optimised, and are the subject of the ongoing collaboration.

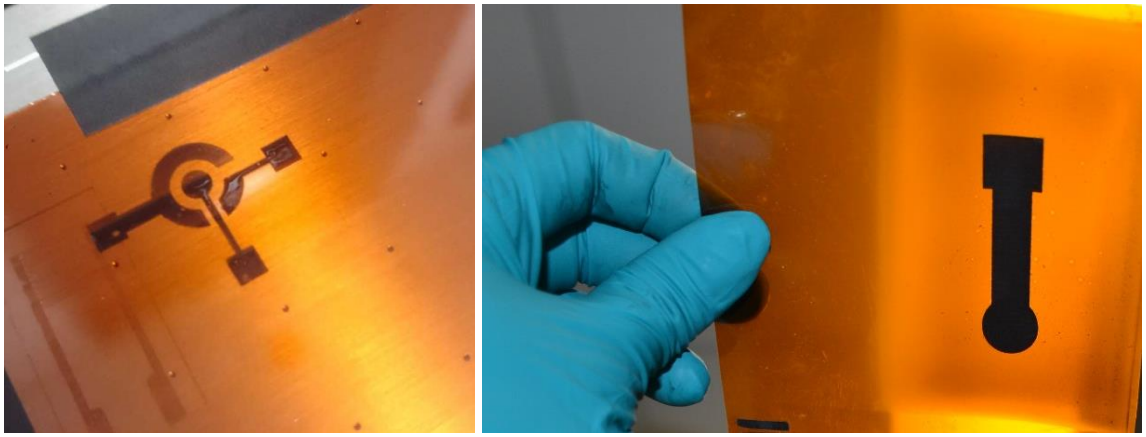

**Fig. 1.** Centimetre-sized printed graphene electronics (electrodes) on polyimide films using graphene inks derived from Archer's Campoona graphite.

The graphene materials, properties, and quality were verified by technical analysis undertaken by The University of Adelaide. The technical analysis included cyclic voltametric experiments that confirmed the capability of printed electrodes to be used in electrochemical biosensing devices.

The results of the technical analysis confirmed that the graphite from the Campoona deposit could be used to produce graphene-based inks and printed electrodes with electronic characteristics in-line with or better than benchmarks set in related research fields, critical for value-add applications and high-quality graphene production using graphitic feedstocks in the targeted areas of human health.

The next steps are now to use the results of the work to secure intellectual property rights to commercially viable technology related to the development and integration of printed graphene componentry for biosensing devices.

Archer CEO Dr Mohammad Choucair commented, "The work with The University of Adelaide Graphene Hub highlights our continued and successful collaborative efforts in executing our advanced materials and technology strategy, and provides Archer with commercial opportunities to develop high-value graphene products and technologies in the focus area of human health, to underpin further development of our Campoona graphite resource."

**Background:**

*Market Summary*

Graphene inks and printed graphene electronic device products form part of the emerging US$2 billion conductive ink technologies market[1] that is set to service niche segments of the

global biosensor market, which is expected to grow to US$27 billion by 2022[2]. Graphene materials and technology are emerging with the potential to broadly impact existing markets that service the electronics industries.

Graphene material sales and device integration are expected to form part of the market value potential of approximately US$70 billion by 2030[3]. The main challenge to widespread adoption of graphene materials has been in developing high-volume and high-value integrated devices and technologies that can be efficiently and effectively scaled, with potential solutions spanning additive manufacturing and highly processable and printable devices.

*The University of Adelaide*

Archer is engaged in a collaboration agreement with The University of Adelaide as part of the Australian Research Council Research Hub for Graphene Enabled Industry Transformation. The collaboration seeks to target high value, high growth markets servicing human health applications by developing and implementing graphene and carbon-based materials for use in complex biosensing devices.

This work is expected to result in the development of all functional elements of a versatile in vitro electrochemical carbon-based biosensor. The carbon-based materials developed would be electronically, chemically and structurally tuneable with nanoscale-level optimisation tailored for electrochemical detection of complex biological molecules in medical testing.

The outcomes of the collaboration directly align with Archer's vision of developing and integrating advanced materials, specifically in the focus area of human health for the betterment of society.

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For more information visit our website
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[1]Ghaffarzadeh, K.; Yamamoto, Y. Conductive Ink Markets 2018-2028: Forecasts, Technologies, Players Silver flake, silver nanoparticles, copper inks and pastes, graphene and beyond. IDTechEx. February 2018. Accessed 30 July 2018.

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[2]Markets and Markets 2017, Biosensors Market by Application (POC, Home Diagnostics, Research Labs, Biodefense, Environmental Monitoring, Food & Beverages Industry), Technology, Product (Wearable and Non-Wearable), and Geography - Global Forecast to 2022. Accessed 19 March 2018, https://www.marketsandmarkets.com/Market-Reports/biosensors-market-798.html

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