ASX Announcement

16 October 2019

Testwork Enhances Graphite Electrode Performance

Hexagon Resources Limited (ASX:HXG, **Hexagon** or the **Company**) has completed key testwork directed at enhancing graphite electrodes used in electric-arc furnaces (EAF) worldwide. Graphite electrodes are an essential part of the EAF steel production process and comprise a significant portion of cost. The market for these graphite electrodes is growing and any technology advances that will extend their service life and lower consumption rates have significant market appeal.

Hexagon is pleased to report the results of its successful preliminary downstream technical development work on the addition of its treated natural graphite as an additive to synthetic graphite electrodes utilised in the high-growth EAF market, to manufacture steel. Testing of flake graphite from its McIntosh Project treated with a proprietary ingredient and branded as "*Performance+"*, has demonstrated a positive and direct correlation between the addition of Performance+ and increased electrical conductivity and durability in synthetic graphite electrodes.

EAF steel producers are the dominant consumers of graphite electrodes, accounting for 90% of all production *(GrafTech International Ltd., 2019)*. With continued strong demand, prices are 135% higher than they were in Q1 2017 *(Roskill, 2019)*.

Graphite electrodes are consumed every 8 to 10 hours in EAF steel production and are therefore an essential input, the purchase of which alone accounts for 3 to 5% of steel manufacturing costs *(GrafTech International Ltd., 2019)*. Testing indicated that Hexagon was able to successfully extend the service life of graphite electrodes by reducing electrode lateral consumption/erosion (oxidative degradation). This was achieved by pre-treating its purified graphite with the Company's proprietary coating, then subsequently mixing the performance-enhancement additive with synthetic graphite to manufacture graphite electrodes.

Extending Electrode Service Life and Lower Energy Consumption.

With Hexagon's specialised natural-graphite performance additive for EAF graphite electrodes, the Company was able to demonstrate reduced energy consumption whilst minimising electrode consumption in normal EAF operations.

Graphite electrodes have high thermal shock resistance (structural integrity) and are used to conduct electricity, while maintaining the ultra-high temperatures (thermal conductivity) of molten steel during EAF steelmaking. Hexagon's technical development work demonstrated a consistent increase in electrical conductivity and lower coefficient of thermal expansion, thereby maximising electrical efficiency and reducing energy consumption.

Hexagon's Managing Director, Mike Rosenstreich commented that "*the results for Performance+ highlight the potential for reduced downtime and lower power consumption*

leading to reduced costs and smaller carbon footprints in the smelting industry. These are essential challenges facing the steel industry and leading to a major transitioning to EAF furnaces in China for example. This strongly endorses our strategy of seeking high-value, deep-market opportunities for our natural graphite as set out in our recent downstream scoping study. Indeed, we are focused on executing that strategy utilising key elements of the scoping study and the vital technical know-how gained by studying the natural graphite flake from the McIntosh Project, doped with a specific ingredient, which together, offer cost efficiencies in steelmaking."

KEY POINTS

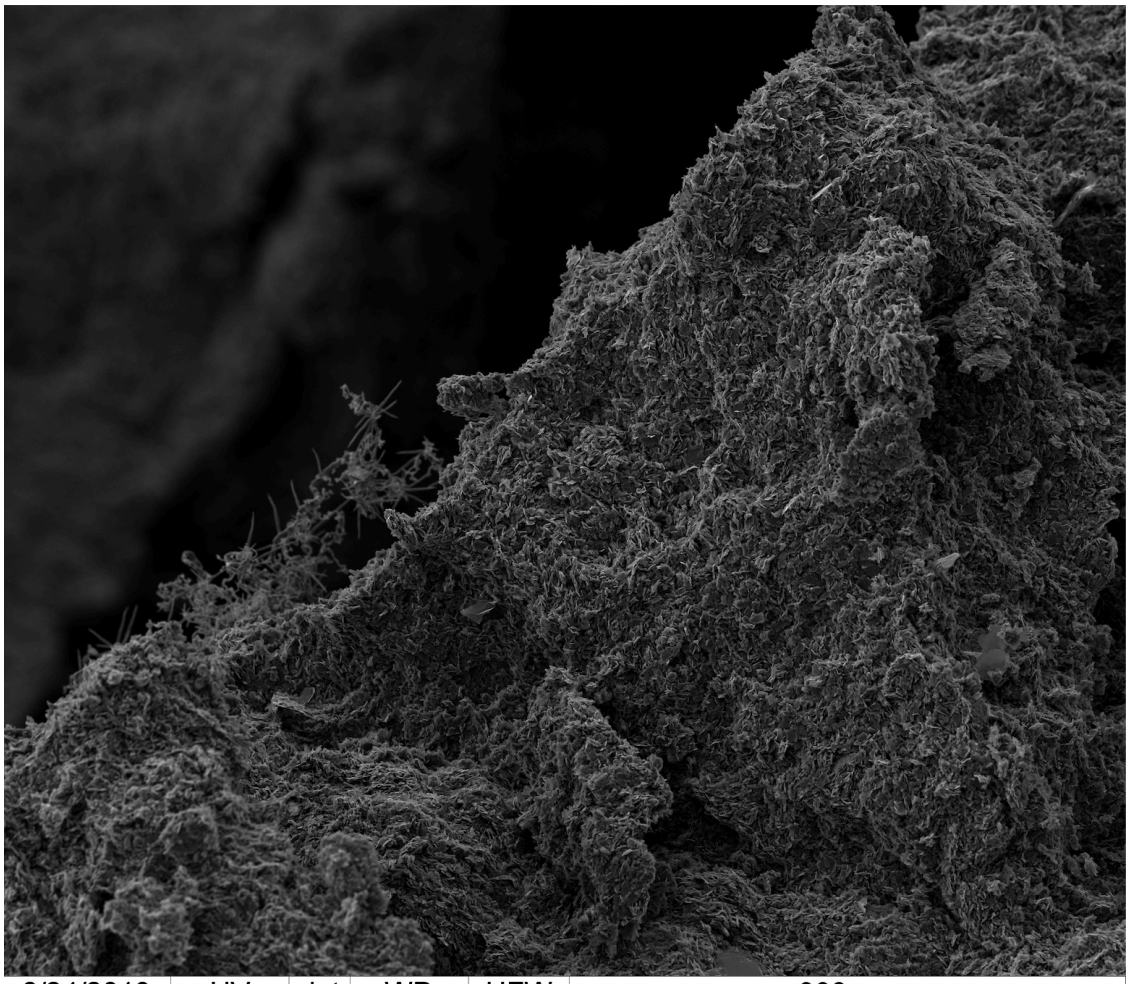
- Hexagon developed and tested its ultra-high-purity[1] natural-graphite concentrate[2] treated with a specific antioxidant additive to optimise performance and reduce the cost of extruded synthetic graphite electrodes. It has branded this material as "Performance+".
- Scanning electron micrographs ('SEM' in Figures 1 and 2) illustrate the detailed microscopic internal structure of the enhanced electrodes being proposed by this testwork.
- The company manufactured a total of 38 extruded graphite electrodes; electrodes manufactured with Performance+ additive demonstrated consistent enhanced electrode performance — including true density, bulk density and electrical conductivity performance — versus the control group (100% synthetic graphite electrodes), specifically;
    - 12% increase in true density
    - 4.5% increase in bulk density
    - 25% increase in electrical conductivity
- These results highlight the potential of increasing electrical performance and increasing durability/service lifetime in graphite electrodes to reduce operating costs. Hexagon's technical development work indicates a potential significant new market opportunity for its transformed graphite material, consistent with the outcomes of its Downstream Scoping Study released in May 2019.
- EAF technology is regarded as the most efficient and environmentally sustainable steel manufacturing process in the world and represents the largest market for graphite electrodes.
- All downstream technical work was performed by NAmLab[3] , Hexagon's US-based independent laboratory and commercial partner. Natural graphite used to manufacture Performance+ was sourced from the Company's McIntosh Graphite Project in Western Australia.
- Hexagon is in discussions with multiple US-based graphite electrode consumers and manufacturers.

Figure 1: A SEM micrograph detailing a cross section of an extruded synthetic graphite electrode, containing 2.5% of Hexagon's Performance+ natural graphite additive.

[1] Thermally purified to ≥ 99.95% Carbon total percentage by weight (wt% C).

2 Graphite flake size fraction of -60/+100 mesh.

[3] NAmLab refers to Hexagon's US-based, downstream technical and commercial partner whose identity cannot be disclosed due to confidentiality obligations.



Performance+ is a thermally purified natural graphite performance-enhancement additive for synthetic graphite electrodes.

1. COMMENTARY

Electric arc furnaces (EAFs) are used to manufacture steel and are regarded as the most efficient and environmentally sustainable production technology currently available. Due to unique physical properties, graphite electrodes are a critical, non-substitutable industrial consumable in EAF-based steel production.

With an average selling price of approximately US$10,000 per tonne, worldwide graphite electrode production capacity was approximately 800,000 tonnes in 2018, forecast to reach 850,000 tonnes in 2019 *(GrafTech International Ltd., 2019)*. Roskill (2019) reports that electrode production consumed approximately 750,000 tonnes of synthetic graphite in 2018, consistent with Graftech's production estimates and underpinning the deep nature of this market opportunity

Made from a petroleum coke precursor, synthetic graphite is engineered to exacting specifications with high purity and predictable electrical, thermal and mechanical properties, but is less conductive and significantly more expensive than natural graphite.

Unlike synthetic graphite, natural flake graphite cannot be sintered (meaning, formed into blocks) and can therefore only be utilised as an additive for electrode applications.

However, given the significant size and strong, enduring demand profile of the graphite electrode industry and in keeping with Hexagon's stated focus on producing downstream highly specialised industrial and energy graphite products, the Company sought to develop a natural-graphite additive to enhance the electrical performance of the synthetic graphite electrodes. In addition to increasing electrical performance, Hexagon sought to extend the service life of graphite electrodes by partially inhibiting electrode decomposition through building an oxidation-resistant layer. Oxidation is the primary limitation to the operational life of graphite electrodes.

2. 'PERFORMANCE+' - DEVELOPMENT OBJECTIVES

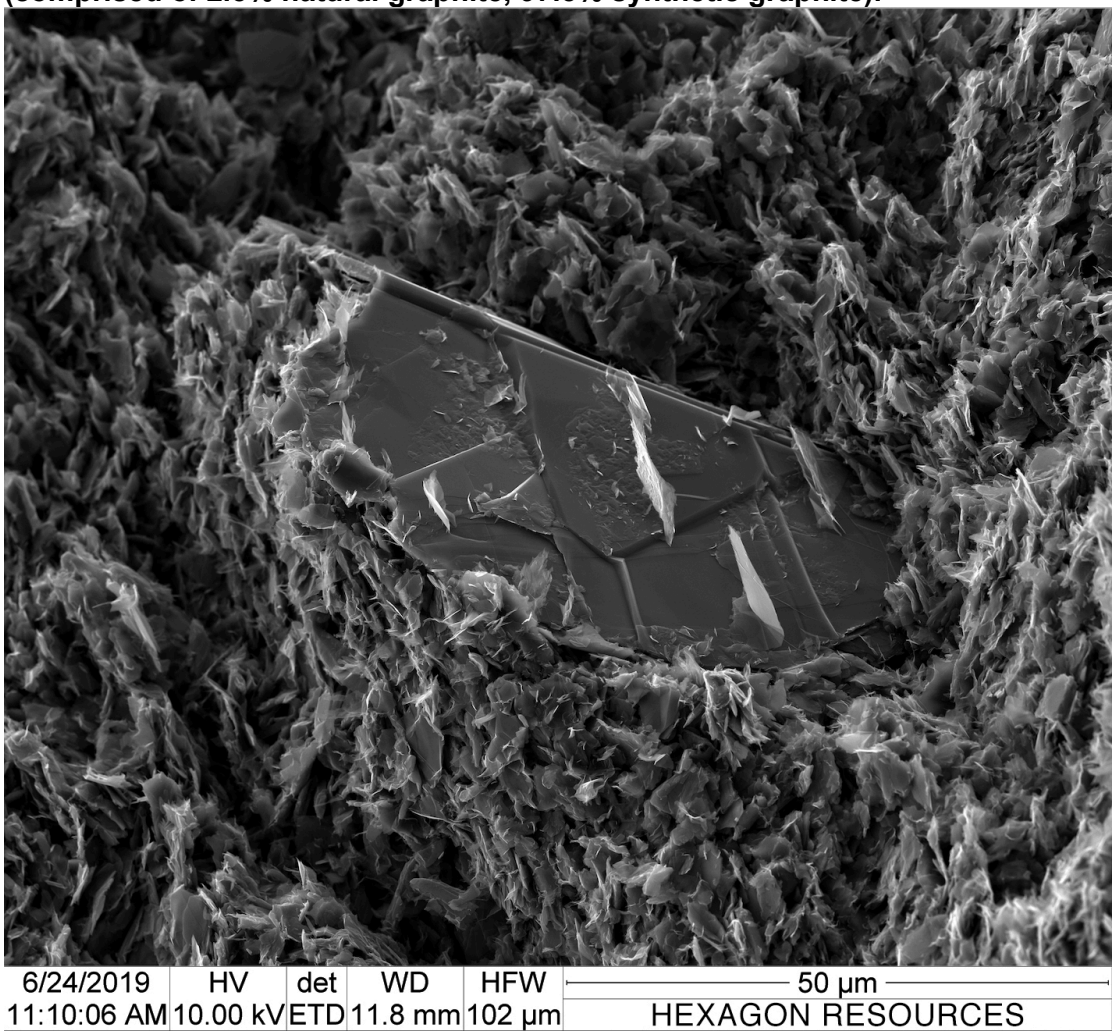
High-quality graphite electrodes have low electrical resistivity and strong durability. Hexagon believed it could improve both these performance characteristics by hybridising a natural-graphite additive in synthetic graphite electrodes.

Purified natural flake graphite exhibits a much higher crystalline structure than synthetic and is therefore more electrically and thermally conductive. The fewer the elemental impurities in the graphite, the better its electrical conductivity. With this understanding, Hexagon sought to achieve maximum electrical conductivity utilising ultra-high-purity natural flake graphite, as opposed to non-purified materials.

Graphite electrode consumption during smelting is a significant component of the cost of steel production in EAF operations. Increased electrical conductivity holds the potential to reduce consumption losses in electrodes by utilising higher voltages and lower currents (long-arc operation). To further enhance electrode service, Hexagon developed a low-consumption-rate antioxidant pretreatment coating in order to reduce electrode consumption losses due to lateral oxidation. Oxidative degradation involves the disintegration of macromolecules by the action of oxygen on the graphite substrate of the electrode.

Oxidation causes graphite to be consumed or burned off during use in the smelting process. When heated in air at elevated temperatures (e.g. when graphite electrodes are dipped into an EAF's molten metal) graphite burns (or gets oxidised), leading to the formation of volatile carbon dioxide. This parasitic loss of carbon as volatile gases is the primary limitation to the operational life of graphite electrodes. By lowering the linear coefficient of thermal expansion (CTE), Hexagon's antioxidant pretreatment coating of the natural flake, improves electrode structural integrity by increasing density (reducing porosity). A low CTE minimises electrode consumption by maximising efficient use of electricity in the EAF while maintaining its structural integrity.

Figure 2: An SEM micrograph of Hexagon's Performance+ natural graphite additive shown in a cross section of an extruded synthetic graphite electrode (comprised of 2.5% natural graphite, 97.5% synthetic graphite).



The fine, ultra-thin sheets are synthetic graphite particles. The significantly larger flake (centre) is Hexagon's Performance+ natural flake graphite additive.

3. BACKGROUND – INDUSTRIAL APPLICATION

To provide context to the significance of the results described above and detailed further below it is useful to provide a brief overview of the industrial electrode manufacturing process and EAF utilisation in steel making – whilst acknowledging other EAF furnace applications may also be relevant.

Manufacturing of graphite electrodes is a highly technical industrial process with very demanding technical specifications that require compliance to ensure efficient EAF operations.

In size, the electrodes maybe up to ~81 cm (32 inches) in diameter, more than ~3.4 m (11 feet) in length and can weigh more than 2.6 tonnes as presented in Figure 3. The manufacturing timeline is between 3 to 6 months.

Operationally, electrode consumption varies between 2 to 3 kg per tonne of steel and 8 to 10 hours of production.

3.1 Graphite Electrode Manufacturing

The graphite electrode manufacturing process includes the following main processes set out below with reference to the testwork samples and presented in Figure 4:

i. ***Screening and mixing*** of raw materials (green or raw petroleum coke) and blending with coal tar pitch to form a dense paste.

   Hexagon's Performance+ additive material was added to synthetic graphite.

ii. ***Formation or extrusion*** of the electrode.

   The paste was passed through a proprietary extruder mixer to form elongated rods of uniform diameter.

iii. ***Calcining or Baking*** of the electrode to decompose and devolatilise (purify) the petroleum needle coke by removing organic materials, moisture and volatile combustible matter, thereby increasing the fixed carbon content, electrical conductivity and real/true density in the resultant calcined petroleum coke (CPC).

   Hexagon's extruded graphite rods were calcined at 900℃ in an inert (nitrogen gas) atmosphere for 15 hours.

iv. ***First Pitch Impregnation ("1PI")*** which consists of impregnating/soaking the electrode with tar pitch binder to reduce porosity or void fractions within the graphite rod to improve strength.

   Following calcination, the graphite rods were soaked in a solution of tar pitch for 1 hour.

v. ***Re-Calcining or Re-Baking*** — this step is to ensure that all voids within the rods are filled with pitch coke binder.

vi. ***Second Pitch Impregnation ("2PI")*** — to ensure that all gaps within the rods are filled with pitch coke binder.

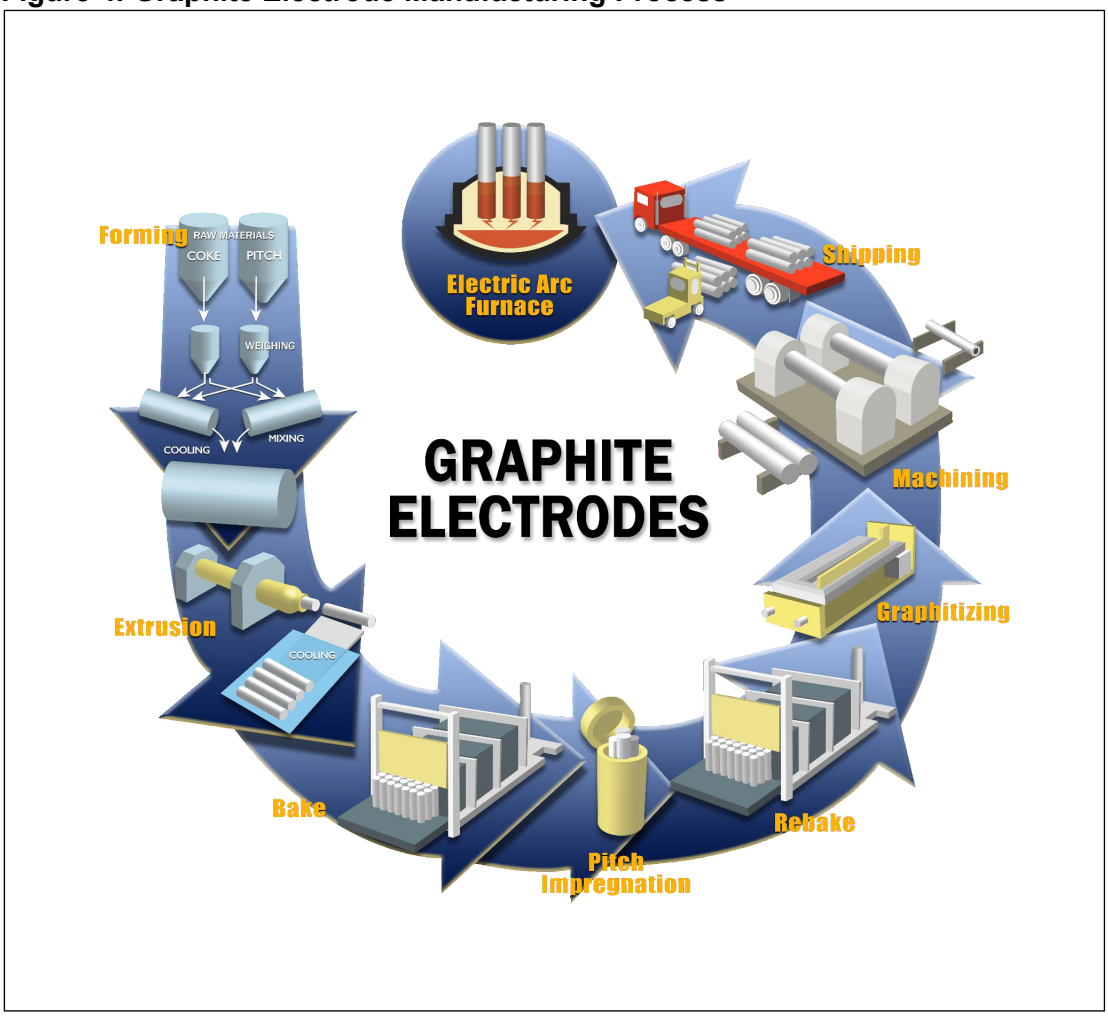
vii. ***Graphitisation*** — removes additional impurities and improves the electrodes' key qualities: thermal and electrical conductivity, thermal shock resistance performance, lubricity, and abrasion resistance.

viii. ***Machining*** to create the exact sizes and smooth surface.

Figure 3: Typical Graphite Electrode

Source: www.steeluniversity.org, 2019

Figure 4: Graphite Electrode Manufacturing Process



Source: GrafTech International Ltd, 2018.

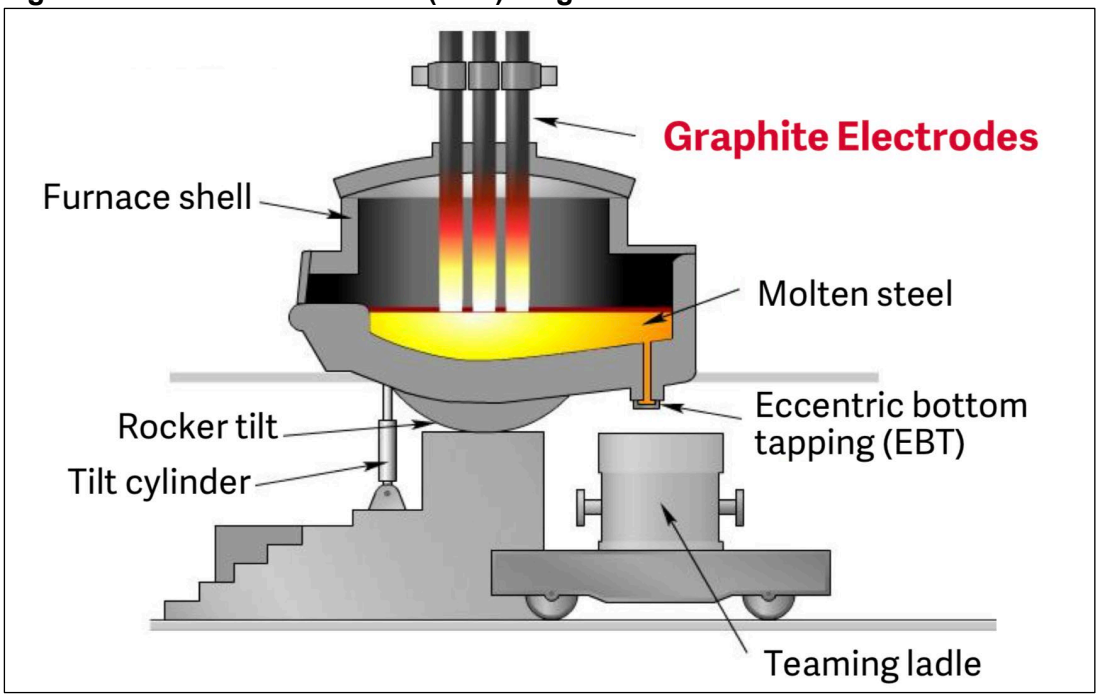
3.2 EAF Steel Industry

EAF steelmaking grew at an annual pace of approximately 14% in 2017, compared with 4% for steelmaking overall. As a result of the increasing global availability of steel scrap and the more resilient, high variable cost and environmentally friendly EAF model. Electric vehicle (EV) battery demand for petroleum needle coke has constrained supply and pushed market prices higher.

Roskill reports (2018) that EAF steel production accounts for approximately 27% of global production but only 7% of Chinese steel production. There is a positive growth outlook particularly in China where government initiatives are forcing a transition to EAF smelting from the historical dominance of basic oxygen furnace (BOF) steel producers. These initiatives are the result of efforts to eliminate excess steelmaking production capacity and to improve environmental conditions. The EAF method (refer to Figure 5) produces approximately 25% of the carbon dioxide (or CO_2) emissions of a BOF facility and does not require the smelting of virgin iron ore or the burning of coal. Additionally, as a result of significantly increased steel production in China since 2000, the supply of Chinese scrap is expected to increase substantially, which may result in lower scrap prices and provide the Chinese steel manufacturing industry with local scrap feedstock that was not historically available. Hexagon believes these trends will allow EAF steel producers to increase their market share and grow at a faster rate than BOF steel

producers, resulting in increasing demand for graphite electrodes, which in turn, will create a potentially significant demand and commercial adoption for EAF electrode enhancement additives that reduce costs and increase performance in EAF electrodes.

Figure 5: Electric Arc Furnace (EAF) diagram



Source: www.steeluniversity.org, 2019

4. TEST RESULTS

Performance+ testing in graphite electrodes indicated a direct relationship between the amount of natural graphite added to the electrode matrix and increased performance of several electrode properties, including (refer Tables 1-3):

- increased electrical conductivity
- higher bulk density
- improved mechanical properties
- a potential for extended electrode service life

As weight percent addition of natural graphite to synthetic increased, the density of electrodes increased reaching an impressive 1.62 g/cm^3 at 2.5 wt.% flake addition to the electrode mix.

Further, testing consistently outperformed the all-synthetic control in density and conductivity.

The following section discusses three key testwork parameters; Bulk Density, True Density and Electrical Conductivity.

4.1 Bulk Density

Bulk Density is also called apparent density or volumetric density. It is a characteristic of a volume of divided material such as powders, grains, and granules.

The best result was a 4.5% improvement from 1.55 g/cm^3 to 1.62 g/cm^3 for the 2.5% Performance+ addition.

Density can be both an indicator and result of the particle size, strength and porosity inherent in a specific graphite material, because the larger the particle size and more openings filled with air, the lower the density.

The density of graphite can be adjusted by the raw materials, formulation and manufacturing processes used to create the specific material grade during initial production. The finished graphite material's density may also be increased though the use of additives and impregnations that will fill in the open porosity of the base graphite material.

Porosity is an undesirable phenomenon in electrodes as porosity leads to reduced electrode density, and typically, lower mechanical strength and electrical conductivity.

When graphite flakes have been compressed under a high pressure, each of them will come closer and, consequently, the density of bulk graphite becomes higher. Higher density of bulk graphite leads to higher electrical conductivity because there is greater connectivity for the electrons to move across the graphite particle. In contrast, a lower density of the bulk graphite indicates a high level of voids which strongly reduces electron mobility, thus, resulting in a lower electrical conductivity of the bulk graphite.

Bulk density is typically how this value is reported on most graphite material specification sheets.

Table 1: Bulk Density Determinations

Graphite Electrode	Addition of Natural Graphite (%)	Addition of Synthetic Graphite (%)	Weight before Graphitisation (g)	Weight after Graphitisation (g)	Weight Lost during Graphitisation (%)	Specimen Height (cm)	Specimen Volume (cm^3)	Electrode Bulk Density (g/cm^3)
Hexagon Performance+ additive	**2.5**	**97.5**	**82.9**	**82.3**	**0.72%**	**10.03**	**50.80**	**1.62**
Hexagon Performance+ additive	5	95	64.7	63.7	1.55%	8.44	42.75	1.49
Hexagon Performance+ additive	7.5	92.5	58.1	56.6	2.58%	6.98	35.38	1.60
Hexagon Performance+ additive	10	90	73.5	68.6	6.67%	8.68	43.97	1.56
Control (100% Synthetic Graphite)	0	100	51.1	48.5	5.09%	6.18	31.29	1.55

4.2 True Density Data

True density is determined by taking the mass of a particle and dividing by its volume, excluding open and closed pores. A constant value for a matter, true density is the density of the near net shape.

True density in this case is a measure of how graphitic a material is. The best result was a 12% increase from 1.95 g/cm^3 in the control sample to 2.18 g/cm^3 with a 5% Performance+ addition.

The high true densities suggest that the electrodes are made of highly graphitised material that should be as conductive as possible to furnish the best level of current carrying capability. By testing true density, the graphitisation degree variable was effectively eliminated.

The highest density recorded was the 10% addition of Performance+, although 5% is ideal when the mechanical strengths component is added to the overall equation.

Table 2: True Density Determinations

Graphite Electrode	Addition of Natural Graphite (%)	Synthetic Graphite Content (%)	Electrode True Density (g/cm^3)
Hexagon Performance+ additive	2.5	97.5	1.83
Hexagon Performance+ additive	**5**	**95**	**2.18**
Hexagon Performance+ additive	7.5	92.25	*no data*
Hexagon Performance+ additive	10	90	2.24
Control *(100% Synthetic Graphite)*	0	100	1.95

All electrodes were double pitch-impregnated (2PI).

4.3 Electrical Resistivity Data

Electrical resistivity (also referred to as resistivity, specific electrical resistance, or impedance), is an intrinsic property that quantifies how strongly a given material resists the flow of electric current. A low resistivity indicates a material that readily allows the flow of electric current. Electrical conductivity or specific conductance is the reciprocal of electrical resistivity and measures a material's ability to conduct an electric current.

The best result was a 25% enhanced conductivity with resistivity (the inverse of conductivity) declining from 11.88 µΩ·m in the control sample to 9.01 µΩ·m in the electrode, with a 5% addition of Performance+.

Electrical conductivity of bulk graphite is regarded as a function of its volume density and temperature. In general, increasing the compression pressure mechanically reduces the gaps between carbon particles, directly enhancing the electrical contact. The electrical conductivity of graphite depends on the separation distance between each particle and the average particle size.

The higher the concentration of Hexagon's natural flake graphite in the composition of extruded shapes, the lower the resistivity. This demonstrates that Hexagon's Performance+ additive has a positive effect on the conductivity enhancement phenomenon in graphite electrodes. At 5% and higher, test series became better than the synthetic control with greater percent addition of flake additive to the electrode formulation. Refined flake reached the resistivity level of the 3PI control formulation at 5 wt. % addition of flake to synthetic.

Table 3: Resistivity Determinations

Wt.% addition into synthetic graphite	Hexagon natural graphite performance-enhancement additive 2 PI	Synthetic Control 2 PI	Synthetic Control 3 PI
0	n/a	11.88 μΩ·m	9.24 μΩ·m
2.5	13.60 μΩ·m		
5.0	**9.01 μΩ·m**		
7.5	8.85 μΩ·m		
10.	8.65 μΩ·m		

5. TEST METHODS

5.1 Electrode manufacturing

Graphite electrodes were produced by first mixing petroleum tar pitch suspended in a compatible solvent system, varying amounts of synthetic graphite, Hexagon unpurified or thermally purified graphite, and the doping additive to form a thick paste. The resulting paste was passed through NAmLab's proprietary extruder mixer to form elongated rods of uniform diameter as shown in Figure 6.

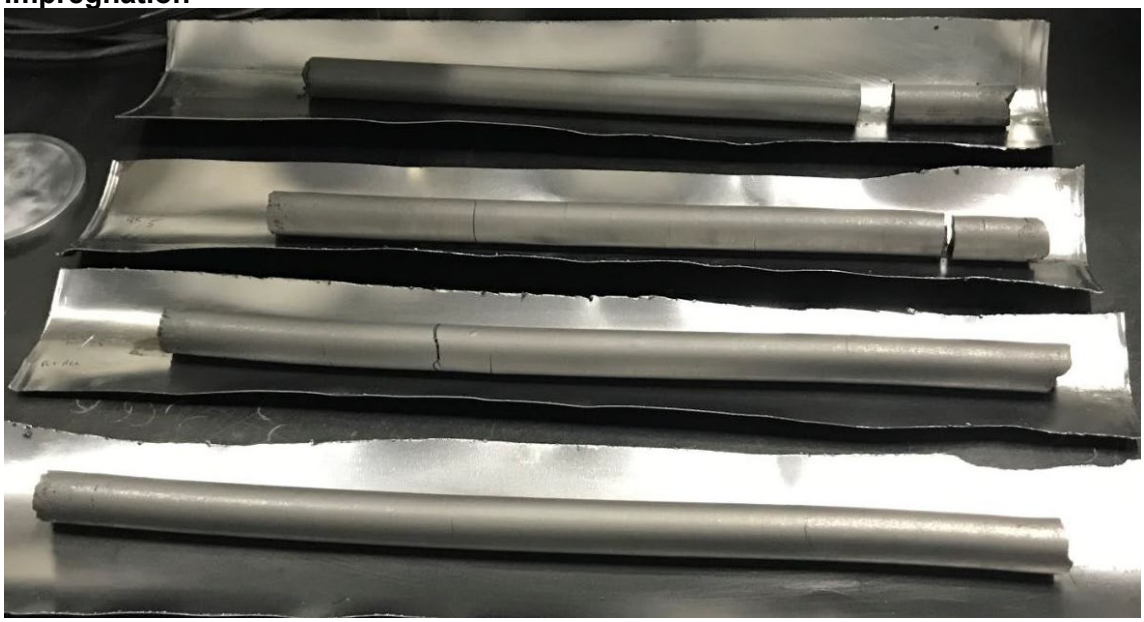
These rods were calcined (i.e. baked) at 900° C in an inert nitrogen atmosphere for 15 hours. Following calcination, the graphite rods were soaked in a solution of tar pitch for 1 hour to allow the pitch to fill any voids, allowed to air dry and then calcined again to convert the tar pitch into pitch coke. Depending on the specific samples, the soaking and calcination steps were repeated one to two more times (i.e. 2PI or 3PI) to ensure that all gaps within the rods are filled with pitch coke binder. Heat treatment makes electrodes harder, but after 2nd PI and especially 3rd PI they also gain strength.

After completion of the final calcination step, the dry weight of the un-graphitised electrodes was measured prior to being graphitised at 2,800° C. Once retrieved from the furnace, the mass of the electrodes was measured to assess the electrode weight loss during the graphitisation process.

The resistivity of the resulting graphitised electrodes was tested in accordance with ASTM C611, which required the machining of electrodes using a lathe and precision cutting tools, to a length diameter ratio of between 6:1 and 4:1.

The true density of 23 electrodes was measured using the Quantachrome Helium Multipycnometer. Since this test required powdered material, testing the true density of the entire electrode was not possible. Instead, the leftover shavings produced during machining of the uneven electrode ends were set aside and crushed; the resulting powder was then used for true density testing. True density is a measure of how graphitic a material is; the theoretical true density of pure crystalline graphite is 2.254 g/cm^3, while a material with a true density of 1.9 g/cm^3 is synthetic and moderately graphitised. It has been argued that the theoretical true density of graphite cannot be measured via helium pycnometry due to the particles' porosity but crushing the electrodes and pressing the powder allowed for a more accurate true density reading.

Figure 6: Extruded "green" graphite electrodes prior to baking and pitch impregnation



5.2 Bulk Density Determinations

The bulk density of electrodes has been determined by dividing the weight of the electrode after graphitisation by its volume. Utilising NAmLab's in-house extruder, the measured values were close to the bulk densities of industrially made electrodes, although some density values were slightly lower. The lowest bulk density recorded in the study was 1.31 g/cm^3 with the highest value at 1.63 g/cm^3 (refer to relevant results in Table 1). For reference, industrially made electrodes range in bulk density from 1.58 to 1.65 g/cm^3.

All electrodes produced in this study had a fixed diameter of 2.54 cm and varying length, which is indicated by the varying weight data in Table 1. Electrodes after a single pitch impregnation (denoted as 1PI) and a single calcination, lost up to 18-23% of mass upon graphitisation. Those electrodes had the lowest density in a given test series, clearly revealing significant amounts of open porosity and are not reported further herein, as they are not relevant to the industry sector.

The electrodes denoted as 2PI had the lowest mass reduction of volatile matter during graphitisation (typically, 0.5 to 5 wt.%). Their resultant bulk density values where notably higher, possibly as a consequence of effective filling of pores in the extruded shapes by pitch.

Importantly, as mass additions of Performance+ natural flake graphite additive to the synthetic graphite increased, the bulk density of graphitised electrodes increased.

5.3 True Density Determinations

As part of this study. NAmLab sought to determine the density (specific gravity) of graphite materials using an analytical method of gas (helium) expansion pycnometry. This is a widely recognised technique for precision determination of volume of crystalline matter – such as graphite electrodes.

Helium pycnometer operates on a principle of gas displacement and the volume-pressure relationship (Boyle's Law). Helium pycnometry is expected to deliver the value of 2.266 g/cm^3 at 293K for a 100%-pure monocrystalline graphite. A Quantachrome Instruments' He/N_2 gas Multipycnometer was used in this study.

The samples comprised powders made from the crushed machine shavings of the 23 electrodes tested. A minimum of two true density measurements were taken for each electrode as a minimum, and the densities were averaged to determine the final true density values as presented in Table 3.

5.4 Electrical Resistivity

The resistivity of graphitised electrodes has been assessed in accordance with ASTM method C 611-98, entitled: "Electrical Resistivity of Manufactured Carbon and Graphite Articles at Room Temperature".

According to the aforementioned test method, a low electric current is run through the graphite electrode to prevent sample heating while the voltage across a specified length of the surface of the graphite electrode is measured to enable calculation of the resistivity. To account for anisotropy in the cylindrical graphite electrode, this measurement is repeated following sequential 90-degree rotations of the electrode and/or by testing of a machined shape in the form of a bar. If testing a cylinder, these four measurements are then repeated using a reversed current flow and switched voltmeter electrode configuration to account for any material memory effects and voltage measurement biases. The result is 16 separate resistivity measurements that, when averaged, provide a representative measure of the graphite electrode's resistivity.

A 4-point resistivity test was conducted on the electrodes and the results presented in Table 3.

6. COMPETENT PERSONS' ATTRIBUTIONS

Exploration Results and Mineral Resource Estimates
The information within this report that relates to exploration results, Exploration Target estimates, geological data and Mineral Resources at the McIntosh and Halls Creek Projects is based on information compiled by Mr. Mike Rosenstreich who is an employee of the Company. Mr. Rosenstreich is a Fellow of The Australasian Institute of Mining and Metallurgy and has sufficient experience relevant to the styles of mineralisation and types of deposits under consideration and to the activities currently being undertaken to qualify as a Competent Person(s) as defined in the 2012 edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves and he consents to the inclusion of this information in the form and context in which it appears in this report.

Metallurgical Test Work Outcomes
The information within this report that relates to metallurgical test work outcomes and processing of the McIntosh material is based on information provided by a series of independent laboratories. Mr. Rosenstreich (referred to above) managed and compiled the test work outcomes reported in this announcement. A highly qualified and experienced researcher at NAmLab planned, supervised and interpreted the results of the NAmLab test work. Mr. Michael Chan was a full-time employee of Hexagon Resources Ltd at the time these results were reported, and he also reviewed the metallurgical test work outcomes. Mr. Chan is a Metallurgical Engineer and a Member of the Australasian Institute of Mining and Metallurgy. Mr. Chan and the NAmLab principals have sufficient relevant experience relevant to the style of mineralisation and types of test-work under consideration and to the activities currently being undertaken to qualify as a Competent Person(s) as defined in the 2012 edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves and had consented to the inclusion of this information in the form and context in which it appears in this report.

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ATTACHMENT 1: JORC TABLE 1.

JORC Table 1 Summary

- Geology – interpretation was undertaken based on a combination of geological logging data from drill holes, surface mapping and modelled conductive plates from the VTEM survey of 2014.
- Drilling method – the drilling method used is a combination of reverse circulation "RC" and diamond. The mineralisation for Emperor is defined by 9 RC drill holes for a total of 1,134 m, 21 diamond drill holes for a total of 2,940.5 m and 9 RC precollar / diamond tail holes for 1,369.3 m. The mineralisation for Longtom is defined by 37 RC drill holes for a total of 4,146 m, 1 diamond drill hole for a total of 54.9 m and 4 RC precollar / diamond tail holes for 620.6 m. The mineralisation for Wahoo is defined by 26 RC drill holes for a total of 2,023 m and 11 diamond drill holes for a total of 1,257.8 m. The mineralisation for Barracuda is defined by 35 RC drill holes for a total of 2,883m and 3 diamond drill holes for a total of 294.0m. Additional RC and diamond tail drilling was undertaken from mid-August to end of October, 2018 at the Emperor, Wahoo mineral resource areas and several prospects, namely Threadfin and Mahi Mahi. This data is still to be compiled and all assays are pending.
- Sampling – one-metre drill chip samples were collected throughout the RC drill programme in sequentially numbered bags. Core samples from diamond drill holes were collected based on geology and a minimum interval of 1m and a maximum of 2m.
- Sub-sampling - analysis was undertaken at ALS laboratory where samples initially undergo a coarse crush using a jaw crusher to better than 70% passing 6mm. Samples exceeding 3 kg were spilt using a Jones Riffle Splitter 50:50. Pulverising was completed to 85% passing 75µm in preparation for analysis.
- Sample analysis method – all samples were sent to ALS for preparation and for Total Graphitic Carbon (TGC), Total Carbon and Total Sulphur (S) analyses. A 0.1 g sample is leached with dilute hydrochloric acid to remove inorganic carbon. After filtering, washing and drying the remaining sample is roasted at 425°C to remove organic carbon. The roasted residue is analysed for carbon using a high temperature LECO furnace with infrared detection for percentage units.
- Duplicate analysis and analysis of Certified Reference Material (standards) and blanks was completed and no issues identified with sampling reliability or contamination.
- Estimation methodology – grade estimation was undertaken using Surpac software to model graphitic mineralisation using a nominal 3% TGC cut-off grade and to estimate TGC by ordinary kriging at Emperor, Longtom and Wahoo and inverse distance (cubed) at Barracuda.
- Resource Classification – classification is based on confidence in geological and grade continuity using the drilling density, geological model, modelled grade continuity and conditional bias measures (slope of the regression and kriging efficiency) as criteria. Indicated Mineral Resources are defined where the drill spacing is sufficient to assume geological and grade continuity and where diamond drill samples have been assessed for graphite quality. As a general rule, drill spacing of 40 m by 40 m or less resulted in an Indicated classification for Emperor and Wahoo and areas with broader spacing are classified as Inferred. For Longtom drill spacing of approximately 25 m by 100 m or less resulted in an Indicated classification and areas with a broader spacing are classified as Inferred. The results from metallurgical test work at the McIntosh project have been considered for Mineral Resource classification. The likelihood of eventual economic extraction was considered in terms of possible open pit mining, likely product specifications, possible product marketability and potentially favourable logistics to port and it is concluded that graphite at the McIntosh Project is an Industrial Resource in terms of JORC Code Clause 49.

- Cut-off parameters – the Mineral Resource is reported above a 3% TGC cut-off grade.
- Mining modifying parameters – planned extraction is by open pit mining and mining factors such as dilution and ore loss have not been applied.
- Metallurgical methods - no metallurgical assumptions have been built into the resource model. Data from mineralogy and preliminary metallurgical test work has been considered for Mineral Resource classification.
- In June, 2017, ALS completed pilot processing program of a 2.4 tonne bulk composite sample collected from diamond core drilling at Emperor and generated 100kg of concentrate to provide samples for potential offtake companies. This material achieved a high graphite grade of 97.6% TGC but because it was targeting a flake size of c. 106 microns, this sample was not representative of the potential recoverable flake size distribution. This is because at that time the Company's marketing focus was solely on a product for the lithium ion battery anode market and the perceived optimum feed size for those plants of c. 106 microns.

  The 445 drill core samples utilised for the ALS bulk sample which were processed into graphite concentrate were each weighed (total weight was 2,383.8kg). Head grade was calculated on a weighted average basis as well as assayed from the 2.4t composite sample (4.77% TGC).

  The 20kg of concentrate that was purified was a subsample of the 100kg generated by the ALS Piloting process obtained by splitting.

  Following purification a spinning riffle splitter was utilised to extract two 15g samples which were then assayed.

  The latest mineralogical examination of drill samples indicates that graphite occurs across a range of sizes from fine to very large flake. Additional test work with a larger data set is currently underway examining the flake size distribution and the flow sheet requirements to preserve larger flake.

  The concentrate assaying and sizing work was undertaken at an ISO 9001:2008 compliant laboratory in the US, highly experienced in graphite applications and test work, utilising conventional assaying and sizing techniques. This same facility has completed two rounds of refining test work; the first on five –sub samples of the concentrate generated at ALS (see above) and the second on a bulk 19.6 kg sample from the same source. Both results indicated the ability to achieve graphite purity of greater than 99.95 wt. % graphitic carbon.

  There is a large body of test work, in progress from sample sources from the Emperor Resource, this comprises two distinct programs:

  a. What is referred to as the "Upstream" test work which is aimed at refining and optimising g the upstream flotation concentration of the ore to a range of graphite concentrate products with specific size specifications;

  b. What is referred to as the "Downstream" test work is to examine and verify the downstream or secondary processing flowsheet parameters and responses to develop a marketing strategy based on the technical attributes of the material and to match it with end-users requirements.

  The following Appendices relate to the bulk sample which was the subject of the downstream testwork being reported. The sample composited in late 2016, and processing as described above was completed in June 2017. Therefore, the main updates are in Section 2 "Other Substantive Exploration Data" which focusses on the methods employed for these tests.

Appendix 1: JORC Table 1 Emperor Resource

Section 1 Sampling Techniques and Data

Criteria	JORC Code Explanation	Commentary
Sampling techniques	• *Nature and quality of sampling* • *Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used.*	**1. Reverse Circulation** • RC drilling used high pressure air and a cyclone with a rotary splitter. • Samples were collected at one-metre intervals. • Approximately 50% of samples were not submitted for assay due to the visual non-mineralised nature of the material collected. All graphitic intervals were submitted for analyses. • Duplicate and standards analysis were completed and no issues identified with sampling reliability. • Samples were sent to the ALS laboratory in Perth for assay preparation and then sent to ALS in Brisbane for Total Graphitic Carbon (TGC) analyses. • All samples were pulverised to better than 85% passing 75µm with a 10 g aliquot taken for assay. • Sampling was guided by Hexagon's protocols and QA/QC procedures. • RC drilling samples of 3 to 5 kg weight were shipped to the laboratory in plastic bags; samples were pulverised and milled for assay. **2. Diamond Drilling** • Drill samples in this program were collected based on geology, varying in thickness from 0.1 m to 2 m intervals. Sampling was completed so samples could be composited to one metre intervals within the geological units. • Core samples were quarter split HQ3 core using a diamond bladed saw and sent to the ALS laboratory in Perth for assay preparation and then sent to ALS in Brisbane for Total Graphitic Carbon (TGC) analyses. • All samples were pulverised to better than 85% passing 75µm with a 10 g aliquot taken for assay. • Duplicate samples, CRM standards and blank material were used during the drill programs. Duplicates collected after each 50 samples. Standards were inserted for samples ending in *00,*20,*40,*60 and *80 and blanks for samples ending in *01,*21,*41,*61 and *81.Sampling was guided by Hexagon's protocols and QA/QC procedures.
Drilling Techniques	• *Drill type (e.g. core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (e.g. core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).*	**1. Reverse Circulation** • RC drill holes (total of 2,154 m from 18 holes) – completed with face sampling hammers and collected through a cyclone. Sample recovery was estimated at a percentage of the expected sample, sample state recorded (dry, moist or wet), samples tested with 10:1 HCl acid for carbonates and graphite surface float. • RC drilling was completed by Egan drilling using an X400 drill rig and United Drilling Services using a DE840 drill rig. **2. Diamond Drilling** • Diamond drill holes (total of 2,940.5 m for 21 holes) – collected HQ_3 core using a 3m core barrel and drilled by Terra Drilling using a Hanjin Powerstar 7000 track mounted rig. Core orientation was recorded using a Reflex EZ Shot instrument. • RC pre-collars were drilled with HQ_3 diamond tails for a total of 1,369.3 m from 9 holes.
Drill sample recovery	• *Method of recording and assessing core and chip sample recoveries and results assessed.* • *Measures taken to maximise sample recovery and ensure representative nature of the samples.* • *Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.*	**1. RC Drilling** • A face sampling hammer was used to reduce contamination at the face. • 1 m drill chip samples, weighing approximately 2 kg were collected throughout the drill programme in sequentially numbered bags. • Split samples were recovered from a cyclone and rig-mounted cone splitter. The sample recovery and physical state were recorded. • Every interval drilled is represented in an industry standard chip tray that provides a check for sample continuity down hole. **2. Diamond drilling**

		• Core recovery was excellent. Recoveries were measured for each run between core blocks and measurements recorded. Core was photographed and logged for RQD and geology. • Analysis from one pair of twin holes drilled at Hexagon's Longtom resource (an adjacent and similar style graphite deposit) noted a lower graphite content in the RC samples when compared with diamond core. Insufficient work has been completed on comparing RC and diamond methods to rule out drilling by RC.
Logging	• *Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.* • *Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography.* • *The total length and percentage of the relevant intersections logged.*	• All RC and diamond drilling (100%) was logged for geology in the field by qualified geologists. Lithological and mineralogical data was recorded for all drill holes using a coding system developed specifically for the Project. Primary and secondary lithologies are recorded in addition to texture, structure, colour, grain size, alteration type and intensity, estimates of mineral quantities, graphite intensity and sample recovery. The oxidation zone is also recorded. • No adjustments have been made to any assay data • Geological logging is qualitative in nature. • Diamond drilling logging also recorded recovery, structure and geotechnical data. • Diamond core was orientated using the Reflex orientation tool. • Core was photographed both dry and wet.
Sub-sample techniques and sample preparation	• *If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry.* • *For all sample types, the nature, quality and appropriateness of the sample preparation technique.* • *Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples.* • *Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/second-half sampling.* • *Whether sample sizes are appropriate to the grain size of the material being sampled.*	**1. RC Drilling** • All samples marked with unique sequential sample number • RC drilling samples were bagged at the drill site in calico bags with a second outer plastic bag to prevent loss of fines. The sample sizes are considered to be appropriate to the grain size of the material being sampled. • 1m RC drilling samples were submitted to either Actlabs Canada or ALS laboratories in Perth. The samples were riffle split on a 50:50 basis, with one split pulverised and analysed for Total Graphitic Carbon (TGC), Total Carbon (TC) and Total Sulphur (TS) using a LECO Furnace, and the other split held in storage. • For RC samples, standards and field duplicates were inserted at an approximate rate of 1 in every 20 samples collected. Duplicate assay results exhibit good correlation with the original assays and no consistent bias is evident. • Sample preparation: 1. Coarse crush using a jaw crushed to better than 70% passing 6mm. 2. For samples exceeding 3kg received mass, riffle split using a Jones Riffle Splitter 50:50 3. Pulverise up to 3kg of coarse crushed material to better than 85% passing 75µm particle size 4. Small aliquot (~10g) taken for assay. **2. Diamond Drilling** • Diamond drill core was cut into half core (used for metallurgical testing) and the remaining half sawn into quarter core using diamond blade core-saw. Quarter core was used for samples and duplicates. Core cutting was carried out under consignment at Westernex in Perth. • Duplicate assay results exhibit good correlation with the original assays and no consistent bias is evident. • Sample preparation: 1. Coarse crush using a jaw crushed to better than 70% passing 6mm. 2. For samples exceeding 3 kg received mass, riffle split using a Jones Riffle Splitter 50:50 3. Pulverise up to 3 kg of coarse crushed material to better than 85% passing 75µm particle size 4. Small aliquot (~10 g) taken for assay. • Sampling procedures and sample preparation represent industry good practice:
Quality of assay data and laboratory tests	• *The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total.* • *Nature of quality control procedures adopted (e.g. standards, blanks,*	• The assaying and laboratory procedures used are industry standard and are appropriate for the material tested. • Sampling was guided by Hexagon's protocols and QA/QC procedures. • For RC samples, standards and field duplicates were inserted at an approximate rate of 1 in every 20 samples collected.

	duplicates, external laboratory checks) and whether acceptable levels of accuracy (i.e. lack of bias) and precision have been established.	• Field duplicates were inserted into diamond core samples at a rate of 4 every 100 samples, standards at a rate of 4 every 100 samples and blanks at 2 every 100 samples. • Statistical analysis of standards, blanks and duplicates during the QAQC process showed that the data was satisfactory. • No issues were identified with sampling reliability
Verification of sampling and assaying	• *The verification of significant intersections by either independent or alternative company personnel.* • *The use of twinned holes.* • *Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols.* • *Discuss any adjustment to assay data.*	• Hexagon QA/QC checks show that all samples are within acceptable limits. No adjustments to assay data have been made based on the analysis of duplicates, standards and blanks. • Standards from ALS laboratory were found to be acceptable. • Duplicate analysis was completed and no sampling issues were identified. • CSA verified several graphite intersections in core and RC chip samples during a visit to Hexagon's warehouse during January 2015. • During a site visit in October 2015, a geological consultant from CSA verified that the diamond drilling, geological logging and sampling practices were of industry standard. The consultant also verified graphite intersections in core samples. • Analysis from one pair of twin holes drilled at Hexagon's Longtom resource noted a lower graphite content in the RC samples when compared with diamond core. It is suggested that RC samples are biased due to the loss of fine material. The majority of samples used in the estimation for Emperor are diamond core. • The Hexagon database is hosted in a SQL backend database, ensuring that data is validated as it is captured and exports are produced regularly. Assay results are merged into the database from the lab certificates limiting transcription or mapping errors from occurring. • No adjustments have been made to the results.
Location of Data points	• *Accuracy and quality of surveys used to locate drillholes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation.* • *Specification of the grid system used.* • *Quality and adequacy of topographic control.*	• 11 diamond core drill holes were sampled using ½, ½ and ¾ drill core to achieve a composite sample considered representative of the Emperor deposit. • These are a subset of a total 48 drill holes. • 45 drill hole collars, including all of the 11 sampled holes, were surveyed using Differential GPS by a surveyor from Savannah Nickel mines for the 2015 program and a contract surveyor (MNG survey) from Broome. The degree of accuracy of drill hole collar location and RL is estimated to be within 0.1 m for DGPS. 3 collars were surveyed using a handheld Garmin 62S and Garmin 76c Global Positioning System (GPS) with a typical ±5 m accuracy. Topography from contours generated from a LiDAR survey was used to validate collar points and assign RL values to the 3 holes surveyed by GPS that had an RL >2 m different to the topography. • Downhole surveys completed for all holes where possible (48 holes). EZshot survey data was used where downhole surveys were not successful. All holes used in the resource have been downhole surveyed using a gyro by ABIM Solutions. • Topographic control was adequate for the purposes of Mineral Resource estimation. • The map projection used is the Australia Geodetic MGA 94 Zone 52.
Data spacing and distribution	• *Data spacing for reporting of Exploration Results.* • *Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied.* • *Whether sample compositing has been applied.*	• Drill spacing on an approximate 40 m by 40 m grid throughout the majority of the deposit, dropping to 40 m across strike by 80 m along strike to the south of the deposit. • Geological interpretation and mineralisation continuity analysis indicates that data spacing is sufficient for definition of a Mineral Resource.
Orientation of data in relation	• *Whether the orientation of sampling achieves unbiased sampling of*	• Holes generally drilled dipping at -60° targeting the fold hinge and limbs.

to geological structure	*possible structures and the extent to which this is known, considering the deposit type.* • *If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.*	• Diamond drill core has been orientated using a Reflex ACE tool 9Act II), with α and β angles measured and positioned using a Kenometer. MapInfo software was used to calculate dip and dip direction for each structure. • The relationship between the drilling orientation and the orientation of key mineralised structures is not considered to have introduced a sampling bias.
Sample Security	• *The measures taken to ensure sample security.*	• Unique sample number was retained during the whole process • RC and diamond samples were placed into calico bags and then into self-sealing plastic bags prior to being put into bulka bags. The bulka bags were then transported by road. RC samples were sent to the ALS laboratory in Brisbane for preparation and analysis and diamond core samples were sent to ALS in Perth for preparation and then to ALS in Brisbane for analysis. A small amount of core samples were sent to Actlabs. • Drill core transported to Westernex was secured on pallets with metal strapping and transported to Perth by road train. • The sample security is considered to be adequate.
Audits or reviews	• *The results of any audits or reviews of sampling techniques and data.*	• Sampling techniques and data collected methods have been audited by CSA during a site visit in October 2015 • Field data is managed by an independent data management consultancy Rocksolid Solutions. • All data collected was subject to internal review

Section 2 Reporting of Exploration Results

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	• *Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings.* *The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.*	• Drilling was recently completed at the Emperor deposit, on exploration leases E80/3864 and E80/4841, Mahi on exploration lease, E80/4825 and Threadfin, exploration leases, E80/4739 and E80/4931. These tenements are held by McIntosh Resources Pty Ltd, a wholly owned subsidiary of Hexagon Resources. Mineral Resources Limited is managing the current exploration on the project under the Joint Venture Agreement signed 7 November, 2018. Mineral Resources has subsequently earned its 51% interest and is continuing the Feasibility Study work.
Exploration done by other parties	• *Acknowledgment and appraisal of exploration by other parties.*	• The East Kimberley has been largely explored for base metals and diamonds with no active previous exploration for graphite. Graphite had been noted by Gemutz during regional mapping in the Mabel Downs area for the BMR in 1967, by Rugless mapping and RAB drilling in the vicinity of Melon Patch bore, to the east of the Great Northern Highway in 1993 and has been located during nickel exploration by Australian Anglo American Ltd, Panoramic Resources Ltd and Thundelarra Resources Ltd over the last 20 years.
Geology	• *Deposit type, geological setting and style of mineralisation.*	• The McIntosh Project graphite schist horizons occur in the high grade terrain of the Halls Creek Mobile Zone of Western Australia. The host stratigraphy is the Tickalara Metamorphic which extend for approximately 130 km along the western side of the major Halls Creek Fault. The metamorphic rocks reach granulite metamorphic facies under conditions of high-temperature and high pressure although the metamorphic grade in the McIntosh Project area appears to be largely upper amphibolite facies with the presence of key minerals such as sillimanite and evidence of original cordierite. • Hexagon has identified potential graphite schist horizons based on GSWA mapping and EM anomalism over a strike length in excess of 15 km within the project area, with potential for an additional 35 km strike length of graphite bearing material from lower order EM anomalism.
Drill hole Information	• *A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes:* • *easting and northing of the drill*	• 21 diamond drill holes for 2,940.5 m and 18 RC drill holes for 2,154 m and 9 RC precollar diamond tail (RD) holes for 1,369.3 m completed at the Emperor deposit. • The location of the 11 diamond drill core holes sampled to provide samples for the 2.4t bulk sample utilised by ALS to

	hole collar • *elevation or RL (elevation above sea level in metres) of the drill hole collar* • *dip and azimuth of the hole* • *down hole length and interception depth* • *hole length.*	generate c. 100kg of graphite concentrate is provided in Table 1 below. • Additional drilling was undertaken in July-August 2017, and between August and October 2018, however these samples were not available at the time the bulk sample was composited.
Data aggregation methods	• *In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (e.g. cutting of high grades) and cut-off grades are usually Material and should be stated.*	• Data compiled in Excel and validated in Datashed by an external data management consultancy. • RC samples were all 1 m in length, diamond core samples vary between 1m and 2 m samples. • Metal equivalents are not reported as this is an industrial mineral project where the mineral properties define grade (e.g. flake size and purity). • A nominal 3% Total Graphitic Carbon cut-off has been applied in the determination of significant intercepts. • The 445 core samples utilised for the ALS bulk sample which was processed into graphite concentrates were each weighed (total weight was 2,383.8kg). Head grade was calculated on a weighted average basis as well as assayed from the 2.4t composite sample (4.77% TGC). • The 20kg of concentrate was a subsample of the 100kg generated by the ALS Piloting process obtained by splitting. • Following purification a spinning riffle splitter was utilised to extract two 15g samples which were then assayed.
Relationship between mineralisation widths and intercept lengths	• *If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported.* • *If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect.*	• Mineralised widths at Emperor are estimated to be typically between 5 m and 70 m, compared with RC samples of 1m width. There is a very close relationship between the graphitic schist unit and Total Graphitic Carbon (TGC%) assays. The presence of graphitic schist is clearly evident in both the RC chips and diamond drill core so that the assay widths can be clearly related to the geological logs. • The graphitic schist horizon has been interpreted as an anticlinal fold. Angled drill holes (generally 60°) have targeted the mineralised unit with the priority to intersect the limbs perpendicular to the strike of the graphitic schist horizon, although in some areas this was not possible and holes were drilled down dip. However interpreted EM data and the width of intersections where holes were drilled perpendicular to the unit have allowed for a good indication of unit thickness to be made and applied in areas where the information is not available.
Diagrams	• *Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations and appropriate sectional views.*	• Not Relevant as metallurgical test work results are being reported. However Figure 1 illustrates where a purification furnace fits in to the downstream flow sheet.
Balanced reporting	• *Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.*	• Metallurgical results for a bulk 19.5kg sample of concentrate are being reported. Two sub samples were analysed and both results reported. As well, all battery critical deleterious elements are reported.
Other substantive exploration data	• *Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.*	*Sample origin for test work reported – 29 April, 2019* • Relevant to the test work being reported – the 2,383kg Emperor bulk sample was selected on the basis of being representative of the Emperor deposit. This material was subsequently crushed, milled and concentrated at a pilot scale to produce 100kg of graphite concentrate grading 97.6% TGC. The purification test results relate to a random, 20kg sub-sample of this concentrate. • Metallurgical test work is underway and being reported progressively on McIntosh concentrate material produced from previous test work. The results reported herein are derived from such a sample. *Background to current testwork report*

		• Earlier work was focused on purification of the graphite concentrate as part of a downstream processing route as well as suitability for it to form certain battery materials such as spherical graphite in lithium-ion batteries. This report provides information on several test work programs examining: - Size reduction through various milling and micronising technologies; - The effectiveness of the ground material to be utilised as conductivity enhancement material in a various battery chemistries; - The suitability of the purified material to be utilised to manufacture technical grade synthetic diamonds. - The suitability of micronised material to be used as mould release agent for foundry application, brake pad/lining and specialty grease/lubricant. This recent work is being managed and undertaken by a well credentialed and experienced private company in the US and Hexagon staff have inspected these facilities. Hexagon has a confidentiality obligation not to disclose the entities name and hence refers to it as NAmLab. The test work completed by NAmLab, was done so in accordance with a detailed scope of work and target size specifications for different planned products compiled by Hexagon. *Milling Testwork* • For the comparative milling tests, unpurified concentrate (as described above) was utilised to preserve the "valuable" high purity sample for other testwork. • *Impact Hammer mills* are effective for size reduction to approximately 10 to 30 µm. For further size reductions Hexagon tested air jet mills and also a proprietary superfine grinding technology being developed by NAmLab. • To assess the potential of Hexagon's McIntosh graphite for the end uses listed in Table 2, a series of sequential hammer milling passes were performed. • *Screened Sample* - For the initial milling trials, a lab-scale hammer mill was used to grind Hexagon's McIntosh graphite samples that were pre-screened to a minus 125 µm and plus 45 µm particle size. Hammer milling was chosen for the initial milling because it represents the most established and economical milling method in a scaled up mode, based on its higher throughput (2,200 lbs/hr) relative to air jet milling (200 lbs/hr). To grind the material, the mill uses four steel hammers, attached to a base plate, which in turn is secured to a horizontal rotor. Rotor speed was kept constant at either 16,000 RPM or 14,000 RPM for all the hammer experiments. Graphite powders were fed into the mill via a funnel while a rotor inside the body was energised to spin counter-clockwise. The hammers impacted the graphite material, reducing it to fine particles. These, in turn, passed through a 325 mesh screen into a transfer pipe, and into the end-product tank. Compressed air, coming from an external source, was used as an airlock; it also assisted with moving the powder and collecting it in the end-product tank and in a filter bag. Once all the material has been milled, the product tank was removed from the mill, and the material was retrieved and analysed. • In order to prepare a pre-screened sample, NAmLab used the Ro-tap RX-29 Tap Test Sieve Shaker machine. • *Air jet milling* test work, NAmLab utilised a 4" air Impact Pulveriser mill which is equipped with counter-opposed nozzles. The air mill forces directly opposing jet streams (incoming from an adjacent air compressor) to cause particle-to-particle, head-on impact, typically four times the impact power of a single force against a stationary object. The mill utilises fluid energy - compressed air, typically at 30 – 80 psi - to produce impact. It has shown to be effective in grinding graphite precursors used in this project; pulverising and sizing to the desired particle dimension in a matter of minutes. • Superfine grinding - In order to superfine materials, NAmLab employed its pilot-scale Super Fine Grinding Mill (SFGM), The SFGM mill is used for reducing the particle size of graphite when size specifications exceed those which can be

		achieved with standard jet milling. The mill has three modes of operation. In the first mode, a set batch of raw material is fed into the size reduction chamber and discharged. In the second, material is continuously pumped through the machine and fed out into a product tank. In the third, raw material is pumped into the machine, discharged back into the feed tank, and processed repeatedly. In the mill, a shaft rotates within the vessel as several spinning blades grind down the particles until they reach a super fine size, which meets the desired end-product specification. After all particles have been ground, the vessel may be removed and the particles emptied into a receiver tank. A supply of water constantly flows through the mill to cool it, and compressed air is used for the discharge process. *CEM Testwork* • The ability of alkaline batteries to operate at high drain currents is limited by the electrical conductivity of the cathode. The higher the cathode conductivity, the better battery performance one should expect. Conductivity is a reverse value of electrical resistance, which can be determined by the 4-point resistivity method. The values of electrical resistivity were determined for EMD/graphite blends using a 4-point resistivity apparatus. Inside a 4-point resistivity jig the powder is confined under a pre-set pressure between four electrically conductive metal surfaces that are electrically insulated from each other by Teflon spacers. The OD of a piston matches the ID of an AA size alkaline battery can, while the OD of an opening in the centre of the piston matches the ID of a typical cathode ring. These parts allow making compressed shapes near identical in size to the dimensions of the cathode rings employed in the actual alkaline cells of AA form factor. The compaction of powdered blends was undertaken in a Carver semi-automatic hydraulic press to the following pre-programmed settings for this test series: 500 kg, 600 kg, 700 kg, 800 kg, 900 kg, and 1,000 kg. While under pressure, the value of electrical resistance for the EMD/graphite matrix was measured by the 4-wire digital Kelvin Bridge. In contrast to classic unidirectional resistivity probes used for measuring conductivity of materials, the operation of the Kelvin Bridge is facilitated by two additional fixed Ohm- value resistors and a circuit of variable resistors. This arrangement is advantageous for the tests conducted under the umbrella of this project, since it minimised the wasteful resistance of the electrical circuit of unidirectional resistor probes. The parasitic resistances are not included in the measurement in the 4-point method. Therefore, the latter provides increased accuracy of measurements in the desired range of measured data points. NAmLab has the following design constants: the diameter of the test specimen (compressed electrode pellet) is 0.4915 inch, radius (r): 0.24575 inch; height L: 0.7210 inches (defined as the distance from the top of upper screw to the bottom of the moulded pellet). The Surface area (A) of the relevant portion of the vertical compression die is calculated as (1): $A = \pi \cdot r^2 = 0.1896\ \text{inch}^2$. (1) The value of resistance (R) is registered by the Ohm meter and converted into resistivity (ρ) by (2): $\rho = R^*A/L = 0.263\ R$, (2) where ρ is expressed in Ohm·inch. The result can optionally be converted into SI units (i.e. Ohm·cm). *Synthetic Diamonds* Technical-grade diamonds are produced out of graphite by simultaneous application of pressure on the order of 50,000 kg/cm^2 and temperature of approximately 1,500°C in specialised presses.

		NAmLab utilised a high pressure high temperature (HPHT) press which incorporates a highly specialised mould as part of its design. Specifically, the graphite/catalyst mixture is pressed into a pellet which is inserted into a sacrificial ceramic shell. The reactive mixture is outfitted with graphite heating elements to improve thermal conductivity of the composite. Unidirectional pressure is applied by conformal pistons which consolidate sacrificial ceramics, which, in turn, apply pressure to the reactive mixture. The pistons are made out of an ultra-hard alloy press-fitted into an outer pressure ring. The outer ring reinforces the inner piston and prevents its breakage. After having applied working pressure, the operator supplies resistive heat emanating from DC current flowing through graphite elements into a pellet composed of a working mixture. The heat and electricity work in conjunction to create a pressure and temperature environment allowing for the formation of the diamonds. While in the press, the graphite melts into a liquid, and, after approximately sixty seconds, the press is turned off, discontinuing the flow of electrical current and allowing the liquefied graphite to cool. During this cooling process, the graphite begins to recrystallise out of a saturated solution of graphite and catalyst, forming the synthetic diamonds. The recovery yield of diamonds is on the order of 50%, but it varies based on the type of graphite. The mixture has to undergo mechanical and chemical separations to segregate diamonds from unreacted graphite. *Analytical Methods* - Following synthesis, testwork focused on the crystal morphology of the synthetic diamonds produced from McIntosh flake graphite, as well as purity aspects of the precursor material. To undertake this work a variety of analytical techniques were employed, including: • *Scanning Electron Microscopy (SEM).* A Hitachi S-3200N High Resolution SEM was employed to produce images of selected samples of cultured diamonds. • *Optical microscopy.* NAmLab utilised its Dino-Lite handheld, test stand-mounted digital microscope with a MicroTouch snapshot feature to image the individual particles in magnification ranges: from 50x to 300x, and 500x for the finest products. • *Analysis of elemental impurities in graphite using the Solid ICP method.* Testing of deleterious elements in graphite for diamond-making was performed through the solid- ICP method (Inductively Coupled Plasma on Solids technology). NAmLab tested dry mineral samples by disintegrating it in a high-temperature furnace in the presence of activating chemicals. All impurities are transferred into a torch to generate the intensity signal tied to their concentration. The ultimate purity is thus detected in a superior manner than the Glow Discharge Mass Spectrometry methods traditionally employed. *EAF Electrode Additive* All electrodes utilised in electric arc furnaces are made of synthetic graphite. Hexagon initiated testwork to examine potential enhancements to the conductivity and durability of those electrodes with the addition of varying quantities of purified flake graphite which had been “doped” with a specific anti-oxidising agent. The results indicated improved conductivity and durability could be achieved utilising the doped flake graphite. The first phase of the work required the manufacture of prototype electrodes which is explained in detail in the body of the report. The key parameters to assess whether enhancements could be attributed comprise measurements of conductivity and for durability, bulk and true density determinations. The methods for

		measuring these parameters are outlined below and in the body of this report. • *Electrical Resistivity* The resistivity (a reverse value of electrical conductivity) of graphitised electrodes has been assessed in accordance with ASTM method C 611-98, entitled: "Electrical Resistivity of Manufactured Carbon and Graphite Articles at Room Temperature". According to the test method, a low electric current is run through the graphite electrode to prevent sample heating while the voltage across a specified length of the surface of the graphite electrode is measured to enable calculation of the resistivity. To account for anisotropy in the cylindrical graphite electrode, this measurement is repeated following sequential 90-degree rotations of the electrode and/or by testing of a machined shape in the form of a bar. If testing a cylinder, these four measurements are then repeated using a reversed current flow and switched voltmeter electrode configuration to account for any material memory effects and voltage measurement biases. The result is 16 separate resistivity measurements that, when averaged, provide a representative measure of the graphite electrode's resistivity. • *True Density Determinations* The density (specific gravity) of graphite materials was determined using an analytical method of gas (Helium) expansion pycnometry. This is a widely recognised technique for precision determination of volume of crystalline matter – such as graphite electrodes. Helium pycnometer operates on a principle of gas displacement and the volume-pressure relationship (Boyle's Law). Helium pycnometry is expected to deliver the value of 2.266 g/cm3 at 293K for a 100%-pure monocrystalline graphite. A Quantachrome Instruments' He/N2 gas Multipycnometer was used in this study. The samples comprised powders made from the crushed machine shavings of the 23 electrodes tested. A minimum of two true density measurements were taken for each electrode as a minimum, and the densities were averaged to determine the final true density values. • *Bulk Density Determinations* The bulk density of electrodes was determined by dividing the weight of electrode after graphitisation by its volume.
Further work	• *The nature and scale of planned further work (e.g. tests for lateral extensions or depth extensions or large-scale step-out drilling).*	*Upstream Flow Sheet* • Continuation of the test work programs gathering mineralogical data, primary processing test work including optimisation of comminution and flotation to improve the Stage 1 process flow sheet. *Downstream Testwork* • Electrical testwork specifically on CEM in EAF-Electrodes and alkaline/primary batteries, lithium-ion battery charge/discharge performance test. BAM spheroidisation and classifying testwork. Also pilot scale thermal purification and downstream production. • Optimisation and further verification of the effects of adding the doped natural flake graphite to electrodes.

Table 1: Location & Drill hole Parameters for Diamond Core Holes sampled for the Pilot Test work undertaken by ALS in 2017.

Hole ID	Hole Type	Grid_ID	East	North	RL	Max Depth
T6GDD164	DD	MGA94_52	389967	8052593	406.0	130.7
T6GDD165	DD	MGA94_52	389908	8052581	408.5	138.24
T6GDD167	DD	MGA94_52	389994	8052435	410.3	183.25
T6GDD168	DD	MGA94_52	390118	8052458	415.2	155.53
T6GDD171	DD	MGA94_52	389954	8052668	399.9	95.05
T6GDD173	DD	MGA94_52	389881	8052655	405.1	141.2
T6GDD176	DD	MGA94_52	389949	8052509	411.8	171.2
T6GDD192	DD	MGA94_52	390004	8052642	405.0	99.2
T6GDD193	DD	MGA94_52	389940	8052547	411.1	201.3
T6GDD194	DD	MGA94_52	389977	8052476	412.6	179
T6GDD195	DD	MGA94_52	389908	8052709	400.3	102.3