

HALIFAX, NOVA SCOTIA / ACCESSWIRE / January 25, 2017 / [Elcora Advanced Materials Corp.](#) (TSX-V: ERA) (FSE: ELM) (OTCQB: ECORF), (the "Company" or "Elcora"), is pleased to announce positive results of lithium ion battery tests using Elcora's graphite powder. These independent tests, performed by Coulometrics, show that Elcora Anode Material ("Elcora Anode Material") show significant advancement and performs at least as well as competitive electric vehicle batteries under HPC testing. The process and performance of other aspects of the battery: cathode, separator, and electrolyte is currently being optimized.

Over the last six months Elcora has worked on developing the processes and equipment to produce high quality anode powder for lithium ion battery anodes. This has been the subject of a number of Elcora news releases over the last few months. We have endeavoured to compare our product with industry leading products at each stage of production to assess the performance of our products.

In the first stage, Elcora developed the capability of reducing the particle size of the source graphite to that required by the spheronization process. Currently this proprietary process has been tested on the graphite coming from our Sri Lankan mine and two other graphite sources with which Elcora has long term supply contracts in place. As of today, these test results refer only to the Elcora Sri Lankan graphite as test work is on-going on the other sources. An example of the Elcora graphite used for spheronization is shown in Figure 1.

In the second stage, the company optimized these processes in order to produce graphite with the characteristics sought by the graphite industry in terms of tap density, BET surface area and grade. This results have, also, previously, been announced. Shown in Table 1 is the most recent data, the range at which Elcora has produced.

Image: <https://www.accesswire.com/uploads/ELCORA12517A.jpg>

Figure 1: Electron microscope picture of Elcora graphite used in the spheronization process

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Table 1: Graphite Performance criteria

Characteristic	Elcora		Others		Units
	Current	Capability	A	B	
Tap Density	1.02	1.06	>0.8	>0.9	g/cc
BET (avg)	7.13	4.48	<12	<9	m ² /g
LOI — Ash content	99.99	99.99	>99.95	>99.95	% Carbon

- The tap density is a measure of the packing of the graphite. The higher this value the better. Our target is greater than 1.0. Competitor values have been under 1.0.
- The BET surface area value should be as low as possible. This value does change with particle size. Our values compare favorably with the established competitors.
- The carbon grade of Elcora graphite after purification is matches and exceeds that of the comparators. However, the Elcora graphite has been produced using our proprietary process without using acid or alkaline processes. This make our product considerably better from an environmental perspective.

In terms of the D_{10/5/90} values, the current Elcora tests show that range as being 13.1 / 28.3 / 53.1. This distribution is shown in Figure 2. This distribution can be adjusted by varying equipment settings. A d₁₀ target of 10 micrometers and the d₉₀ of 30 micrometers are operationally viable, however, this distribution is being optimized on battery performance rather using particle size distribution as the definitive metric.

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Figure 2: Most recent test particle size distribution.

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Image: <https://www.accesswire.com/uploads/ELCORA12517C.jpg>

Figure 3: Electron microscope picture of Elcora spheronized graphite.

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Stage three was the eChemistry, or the ability of the graphite to absorb and release lithium ions as summarized in Figure 2. The results of 20 cycle tests are shown in and illustrated in Figure 3.

Table 2: eChemistry results on the Elcora graphite using Elcora process and spheronization.

Metric	Low	High	Units
Reversible Capacity	355	359	mAh/g
Irreversible Capacity	23.3	23.5	mAh/g
Resistance	67.86	72.56	Ohm
First Cycle Efficiency	93.7	93.8	%

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Figure 4: Elcora spheronized graphite (SG) eChemistry results using graphite with a BET of 3.73 m2/g, LiPF6 (Cathode) in EC/DEC (Electrolyte) with no additives.

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Final stage, completed to date, was the fabrication and testing of standard 2.2 mAh 16850 batteries and High Precision Coulometry (HPC). A formulation for graphite slurry was determined and anodes made. Pictures of the graphite slurry with binders and stabilizers, is shown in Figure 5.

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Figure 5: Elcora Graphite anode slurry

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These tests are used to characterize long term performance of batteries using short term experiments. The efficiency represents reactions within the cell that slowly lower the capacity. Thus, the efficiency should be as high as possible. When a cell is new a solid electrolyte layer forms which causes inefficiencies. With time this formation slows resulting in a tapered curve that eventually forms a horizontal line. This can be seen in Elcora's results (Figure 6) where the eventual horizontal line lies close to 0.998.

The results of these tests compare favorably to tests on industry leading batteries currently used in electric vehicles that show a coulombic efficiency of close to 0.998 as shown in Focus at this point has been on the anodes as this is the Elcora material. These results, without optimizing the cathode, electrolyte and separators show that the Elcora anodes can produce cell that are at least equivalent to the industry leading batteries. The next set of battery tests will compare Elcora anode graphite in cells that are optimized for the other battery components.

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Figure 6: Coulombic efficiency of Elcora battery cells showing the capacity of the cell (mAh) which was designed to be 2.2 mAh, the Coulombic inefficiency with time which is a function of the cell chemistry, and the Coulombic efficiency which is a function until stabilization at the asymptote of the solid electrolyte interphase (SEI) formation with the asymptote occurring the an efficiency that represents the slow degradation of the cell.

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Figure 7: Coulombic efficiency of current batteries used in electric vehicles after asymptote has been reached.

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About Elcora Advanced Materials

Elcora was founded in 2011 and has been structured to become a vertically integrated graphite & graphene company that mines, refines, and processes graphite, and produces graphene. The company's products are then used to manufacture battery grade anode graphite and to develop future graphene based and/or enriched high tech products such as graphene enhanced

silicon anodes for lithium ion batteries. As part of this vertical integration strategy, Elcora has secured high-grade graphite and graphene precursor graphite from its interest in the operation of the Ragedara mine in Sri Lanka which is already in production. Elcora has developed a unique low cost effective ecological processes to make high quality battery grade and battery form graphite and graphene at commercial scale. This combination means that Elcora has vertically integrated the tools and resources required to produce graphite, micro-graphite and graphene.

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SOURCE: Elcora Advanced Materials