Miller Graphite Significantly Purer Than Commercial Synthetic Graphite Marketed for Use in Small Modular Nuclear Reactors

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VANCOUVER, May 06, 2019 - Canada Carbon (the “Company”) (CCB:TSX-V) (BRUZF:OTC) (U7N1:FF) is pleased to announce that the Company has obtained market leading and statistically significant test results which indicate that, when compared with a synthetic nuclear grade graphite reference material, the Miller thermally purified natural graphite had far fewer detectable elemental contaminants overall, and significantly lesser amounts of those that were detectable.

Executive Chairman and CEO R. Bruce Duncan commented, “The new analytical results reported here are based on the direct comparison of the Miller graphite to a Certified Reference Material ("CRM") by 10 independent international labs and provide further evidence of the purity advantage of the Miller natural graphite over the commercially available synthetic graphite SGL NGB-18 which is being considered for use in small modular reactor development programs around the world. We anticipate that the Miller graphite will be classified as the standard by which all natural and synthetic nuclear grade graphites will be assessed.”

Technical Notes

A breakdown of the results can be found in Table 1, below.

Canada Carbon’s thermally upgraded Miller graphite was made available for method development work conducted by Subcommittee D02.F0 on Manufactured Carbon and Graphite Products of ASTM International, as first reported September 30th, 2015. The analytical devices employed for this new analytical method used Electro Thermal Vaporization & Inductively Coupled Plasma Optical Emission Spectrometry (“ETV-ICP OES”), which has now been shown to have the capability to decrease the elemental impurity detection threshold to parts per billion by weight in nuclear graphite samples. The new ASTM standard test method based on these results is expected to be published before the end of 2019.

The ASTM procedure to develop this new standard method for ultra-trace impurity determination in nuclear graphite grades involved supplying ten international laboratories equipped with ETV-ICP OES with a nuclear-grade CRM for instrument calibration, and identical samples of unknown nuclear purity graphite for later comparison of the measured impurity content detected by each lab. Statistical analysis indicating significant congruity of the collected analytical results for the unknown sample would serve to validate the method used. The CRM used was a commercial material identified as BAM-S009 (SGL NBG-18 synthetic nuclear grade graphite powder) and the ‘unknown’ was thermally purified natural graphite from the Company's Miller deposit. Each laboratory was to determine the concentrations of 21 elemental contaminants within each sample. 20 elemental contaminants were detected in the CRM by all 10 laboratories, whereas only 7 were detected in the Miller graphite. Of the 7 elements detected in the Miller graphite only 4 of the elements were detected by all 10 laboratories. (Please refer to the notes accompanying Table 1 for details.)

Statistical analysis of the compiled data showed that the CRM contained significantly higher amounts of the 7 elements than were found in the Miller thermally purified natural graphite. The CRM contaminant load for the seven elements ranged from 3.3 to 84.4 times higher than for the Miller graphite.

Executive Chairman and CEO R. Bruce Duncan further stated, “In the past (May 13th, 2015 press release), Canada Carbon reported on the comparative purity of its graphite by comparing its elemental contaminants with information available from an assessment made by Oak Ridge National Laboratory of other candidate nuclear graphites in 2011. Canada Carbon’s thermally treated Miller graphite

contained only a small fraction of the selected elemental contaminants (0.99 ppm) when compared to the best natural graphite (Asbury RD 13371, at 36.55 ppm) and substantially lower contaminant levels than the best synthetic graphite samples SGL KRB-2000 (4.53 ppm) and the experimental GrafTech GTI-D (8.1 ppm). Today’s results confirm the purity advantage enjoyed by Canada Carbon’s Miller graphite.”

With these results in hand, the Company also wishes to disclose that it is in negotiations to have its Miller ultra-high purity natural graphite made available as a Certified Reference Material for laboratory use in instrument calibration for GDMS and ETV-ICP OES. Further developments in this regard will be reported when details are finalized.

Synthetic graphite for use in a nuclear reactor is typically supplied as a molded and machinable block known as a billet. It is formed during a lengthy high-temperature treatment of green billets made from a blend of petroleum coke particles and graphitizable binding resin. The Company is in the planning stage for developing a similar machinable graphite billet based on its ultra-high purity Miller graphite and graphitizable binding resin. If successful, this new material will significantly expand the applications for the Miller nuclear purity graphite within a reactor setting.

TABLE 1: ELEMENTAL CONTAMINANT CONCENTRATIONS FOR CCB MILLER NATURAL GRAPHITE AND COMMERCIALLY AVAILABLE SGL NBG-18 SYNTHETIC NUCLEAR GRAPHITE

ELEMENTAL CONTAMINANT	CCB MILLER MEAN CONC. (PPB)[1]	SGL NBG-18 MEAN CONC. (PPB)[1]	CONTAMINANT RATIO CCB:SGL[2]
Al: ALUMINUM	580[4]	1940	1:3.3
B: BORON	ND[3]	1320	
Ba: BARIUM	ND	1090	
Ca: CALCIUM	160	13500	1:84.4
Co: COBALT	20[4]	150	1:7.5
Cr: CHROMIUM	ND	1520	
Cu: COPPER	ND	350	
Fe: IRON	5360[5]	36200	1:6.8
K: POTASSIUMI	60	3120	1:52
Li: LITHIUM	ND	200	
Mg: MAGNESIUM	30	270	1:9
Mn: MANGANESE	ND	1230	
Na: SODIUM	260	3010	1:11.6
Ni: NICKEL	ND	5080	
S: SULPHUR	ND	ND	
Sr: STRONTIUM	ND	320	
Ti: TITANIUM	ND	27100	
V: VANADIUM	ND	920	
W: TUNGSTEN	ND	270	
Y: YTTRIUM	ND	100	
Zr: ZIRCONIUM	ND	1140	

Notes:

1. All concentrations are parts per billion by weight, the arithmetic mean of values reported by 10 laboratories (except as per notes 4 and 5). Calculated means have been rounded.
2. Simple ratio of average mean concentrations of the specified elements for the two samples.
3. ND = Not Detected.
4. Detected by 3 labs.
5. Detected by 4 labs.

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