GEOLOGICAL SOCIETY OF SRI LANKA
(GSSL)

Proceedings of the 36th Annual Technical Sessions

"Global Challenges and the Role of Geologists"

28th February 2020

At the Solis Hotel, Pita Kotte

ABSTRACTS

Joint Editors

Nadeesha H. Koralegedara
Amila Ratnayake

Proceedings of the 36th Technical Session of Geological Society of Sri Lanka, 2020
Published Online – 28th February 2020 (http://www.gsshweb.org)

GSSL-2020-T3-S3/04

SCALING-UP AND OPTIMIZATION OF ACID LEACHING METHOD FOR PURIFICATOIN OF VEIN GRAPHITE FOR THE LI-ION BATTERY APPLICATION

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Lithium-Ion Battery (LIB) as advanced battery technology has become the most prominent battery and research field in the world. Presently, natural graphite has been developed for the anode application of the rechargeable LIB. This development of battery-grade graphite had involved various purification techniques based on thermal, mechanical and chemical routes. Recently, the acid leaching method, which has been patented elsewhere, was identified as one of the best methods to purify the natural vein graphite. Under this method, Sri Lankan vein graphite was purified using aqueous HCl solutions of 5 to 25 vol.% by heat treating at 60 °C in a laboratory scale (< 5.0 g) and it resulted purify over 99.98%. Further, the LIB assembled with the developed vein graphite anode has shown promising electrochemical performances. In continuing, the optimization followed by scaling-up of this acid leaching method is a key-factor for practical commercialization and mass-scale production of battery-grade vein graphite. The study aims to optimization and scaling-up of the acid leaching method for the purification of vein graphite. Under that, different weight of graphite:acid used to acid leaching method were tested in order to obtain optimum performance of this process. Analysis of carbon content revealed that these scaled up samples can be increased carbon percentage over 99.9%.

Through the X-ray diffraction analysis of the raw sample showed the existence of minor phases of pyrite, chalcopyrite, and calcite, their impurity phases were absent in the scaled-up purified graphite. All the scaled up purified graphite resulted this similar crystallographic behavior even though their C% is slightly varying depending on the selected graphite:acid ratio. Galvanostatic charge–discharge study of the LIB coin cells assembled with the optimized scaled upgraded graphite as the anode material resulted in the significant reversible capacity of 376 $mAhg^{-1}$ with Coulombic efficiency of 99.8%. Hence, LIB assembled with battery-grade vein graphite developed by optimization followed by scaled-up acid leaching method in this study showed promising electrochemical performances. Therefore, the natural vein graphite developed through optimization and scaling-up of acid leaching method can be successfully used as an anode material for the commercial application and mass production of LIB.

Keywords: *Vein graphite, purification, optimization, scale-up*

Acknowledgement: *The financial assistance by the General Treasury under a cabinet paper of the Government of Sri Lanka (No: 17/1907/16/038 on 2017-08-09) is highly acknowledged.*