Nickel is a Critical Material for Lithium Ion Batteries

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9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Nickel is emerging as a significant supply bottleneck in the growth of manufacturing capacity for lithium ion batteries for use in electric vehicles (EVs) and grid storage. Less than half of current worldwide nickel production is capable of economically producing the Class One nickel required for batteries. Ethical sourcing of materials is also a concern. Nickel has excellent capacity to store electrons. It is a key cathode material in the dominant lithium ion battery chemistry: Nickel Manganese Cobalt (NMC). In an effort to increase the range of EVs, battery manufacturers are striving to increase the nickel content of their battery chemistry while maintaining the stability of the batteries. Cathode chemistry has evolved from NMC 111 (1 part Ni, 1 part Mn, 1 part Co) to the current NMC 532 and 622, and NMC 811 is just starting commercial rollout and is expected to make up 75% of the battery mix by 2025. Only high-purity Class 1 nickel is suitable for battery production. Globally, nickel deposits exist in two main forms, sulphide and oxide (laterite). Laterite deposits make up the bulk of known, unexploited nickel deposits in the world. The higher-grade saprolite portions of lateritic nickel deposits are an important source of impure ferronickel for the stainless steel industry and have only rarely been exploited to make nickel suitable for refining to Class 1. Most Class 1 nickel is sourced from deposits of nickel in sulphides processed by froth flotation to make a sulphide concentrate which is amenable to further purification by smelting or by pressure oxidation. The other significant source of Class 1 nickel is from the lower-grade limonite portion of lateritic nickel deposits, processed by High Temperature, High Pressure Acid Leach (HPAL).Processing of sulphides is well understood and reliable, but most good, large deposits have been exploited and few significant deposits have been discovered in the last 30 years. HPAL has a more checkered

history with many instances of either technical or financial failure or both. HPAL projects bring significant environmental challenges with disposal of the fine, acidic, sulphate-laden tailings and acidic effluent streams. Treating the materials and suitably disposing of them, whether on-land or in the ocean, poses both financial and technical challenges. Giga Metals has a large, low grade deposit of nickel in sulphides in British Columbia, Canada. The host rocks are silicates, which are relatively benign in terms of tailings storage. In addition, research is showing that silicate tailings are an effective carbon sink. Exposure of ground silicates to atmospheric or concentrated CO2 promotes conversion of silicate minerals to carbonate minerals. The CO2 remains locked in the carbonate minerals over geologic time scales.