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INTEGRATION OF HYDROMETALLURGY PROCESS AND MINERAL CARBONATION TECHNOLOGY

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ABSTRACT

The metal smelting and refining field is facing a dilemma to satisfy the social demand to reduce carbon dioxide (CO_2) emissions while maintaining supply chains by fulfilling the increasing demand for metal resources, such as for batteries and magnetics, as high-grade mineral resources continue to become depleted. Regardless of the market requirements, the need to respond to such social demands cannot be ignored.
Carbon dioxide capture, usage and storage (CCUS) is one of the measures to reduce CO_2 emissions, and JGC has been developing its own technology by focusing on a CCUS using mineral carbonation (CO_2 mineralization).
CO_2 mineralization is a technology that reacts with and solidifies CO_2 by forming chemical compounds with calcium and magnesium (Ca and Mg) sources such as basic rocks. As to the methodology of the reaction, a high-pressure method is commonly known, but JGC has been focusing instead on a method at atmospheric pressure.
In the beginning, a CO_2 mineralization method using serpentine had been studied, however, a simplified economic study showed a negative result in terms of profitability due to its limited income based on CO_2 credits and magnesium carbonate sales revenue alone.
Conversely, in the field of nickel hydrometallurgy, sulfuric acid leaching methods, such as high pressure acid leach (HPAL), are attracting attention in recent years because the process produces nickel sulphate and mixed hydroxide precipitate (MHP) as the precursor materials of lithium ion batteries (LiB) from nickel laterite ores. However, high-Mg ores have no affinity to the acid leaching process, as its Mg consumes the acid reagent and lowers the feasibility, therefore, high-Mg ores have not been actively processed but probably stockpiled at mine sites. JGC has developed a method to integrate the sulfuric acid leaching process and CO_2 mineralization, which converts high-Mg ore into a nickel resource and reduces CO_2 emissions at the same time.
This paper introduces the abovementioned JGC's methodology and results of laboratory tests using actual nickel laterite ore samples and describes the improvement in a simplified economic study.

Keywords: carbon dioxide mineralization, sequestration, mineral carbonation, sulfuric acid leach, nickel laterite ore