World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:17, No:05, 2023

Gas Phase Extraction: An Environmentally Sustainable and Effective Method for The Extraction and Recovery of Metal from Ores

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Abstract : Over the past few decades, the demand for metals has increased significantly. This has led to a decrease and decline of high-grade ore over time and an increase in mineral complexity and matrix heterogeneity. In addition to that, there are rising concerns about greener processes and a sustainable environment. Due to these challenges, the mining and metal industry has been forced to develop new technologies that are able to economically process and recover metallic values from low-grade ores, materials having a metal content locked up in industrially processed residues (tailings and slag), and complex matrix mineral deposits. Several methods to address these issues have been developed, among which are ionic liquids (IL), heap leaching, and bioleaching. Recently, the gas phase extraction technique has been gaining interest because it eliminates many of the problems encountered in conventional mineral processing methods. The technique relies on the formation of volatile metal complexes, which can be removed from the residual solids by a carrier gas. The complexes can then be reduced using the appropriate method to obtain the metal and regenerate-recover the organic extractant. Laboratory work on the gas phase have been conducted for the extraction and recovery of aluminium (Al), iron (Fe), copper (Cu), chrome (Cr), nickel (Ni), lead (Pb), and vanadium V. In all cases the extraction revealed to depend of temperature and mineral surface area. The process technology appears very promising, offers the feasibility of recirculation, organic reagent regeneration, and has the potential to deliver on all promises of a “greener” process.

Keywords : gas-phase extraction, hydrometallurgy, low-grade ore, sustainable environment
Conference Title : ICMEH 2023 : International Conference on Metallurgical Engineering and Hydrometallurgy
Conference Location : Montreal, Canada
Conference Dates : May 15-16, 2023