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Extractive Metallurgy and Mineral Processing: An Overview

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Perspective

Extractive metallurgy is a sub eld of metallurgical engineering that studies the processes and methods of extracting metals from their natural mineral sources. e eld is a materials science that covers all aspects of ore types, washing, concentration, separation, chemical processes, and extraction of pure metal and their alloying to suit various applications, sometimes as a nished product, but more o en in a form that requires further work to achieve the given properties to suit the applications.

Mineral processing starts with bene ciation, which entails rst breaking down the ore to the needed sizes depending on the concentration procedure to be used, followed by crushing, grinding, sieving, and so on. Following that, depending on the nature of occurrence and/or further process required, the ore is physically separated from any undesired impurities. e physical qualities of the materials are used in separation operations. Density, particle size and shape, electrical and magnetic properties, and surface properties are examples of physical properties. Magnetic separation, froth otation, leaching, and other major physical and chemical processes are used. Ore bodies frequently contain multiple precious metals. Tailings from a previous operation can be fed into another process to obtain a secondary product from the original ore. A concentration may also contain more than one precious metal. is concentrate would next be treated in order to separate the valuable metals into their respective constituents. Mineral processing and metal extraction are both energy-intensive operations that generate enormous amounts of solid residues and wastewater, both of which require energy to clean and dispose of.

Furthermore, as metal demand grows, the metallurgical sector must rely on materials with lower metal concentrations derived from primary (e.g., mineral ores) and/or secondary (e.g., slags, tailings, municipal waste) raw materials. As a result, mining activities and waste recycling must improve in order to create more selective, e cient, and ecologically friendly mineral and metal processing pathways. Mineral processing operations are required rst and foremost to concentrate the mineral phases of interest and eliminate undesired material that is physically or chemically related with a speci c raw material. However, the process requires approximately 30 GJ/tonne of metal, which accounts for approximately 29 percent of total energy used on mining in the United States. Meanwhile, pyrometallurgy is a major source of