

## Iron Recovery from Red Mud as Zero-Valent Iron Metal Powder Using Direct Electrochemical Reduction Method

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**Abstract :** In this study, the feasibility of the direct electrowinning method was used to produce zero-valent iron from red mud. The bauxite residue sample came from the Tayan mine, Indonesia, which contains high hematite ( $\text{Fe}_2\text{O}_3$ ). Before electrolysis, the samples were characterized by various analytical techniques (ICP-AES, SEM, XRD) to determine their chemical composition and mineralogy. The direct electrowinning method of red mud suspended in NaOH was introduced at low temperatures ranging from 30 - 110 °C. Variations of current density, red mud: NaOH ratio and temperature were carried out to determine the optimum operation of the direct electrowinning process. Cathode deposits and residues in electrochemical cells were analyzed using XRD, XRF, and SEM to determine the chemical composition and current recovery. The low-temperature electrolysis current efficiency on Redmud can reach 20% recovery at a current density of 920,945 A/m<sup>2</sup>. The moderate performance of the process was investigated with red mud, which was attributed to the troublesome adsorption of red mud particles on the cathode, making the reduction far less efficient than that with hematite.

**Keywords :** red mud, electrochemical reduction, Iron production, hematite

**Conference Title :** ICMMPME 2023 : International Conference on Mining, Mineral Processing and Metallurgical Engineering

**Conference Location :** Taipei, Taiwan

**Conference Dates :** March 06-07, 2023