

Effect of Microwave Power On Extraction of Nickel-Iron Alloy From Laterite Ore Assisted By 5.8 GHz Microwave Irradiation

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In recent years, the use of storage batteries has rapidly progressed toward the realization of a carbon-neutral society. Nickel, which has been used as a material for stainless steel, is currently attracting attention as a high-efficiency battery material. On the other hand, currently, a lot of carbon is used in the refining of nickel. Decarbonization in nickel smelting is an urgent issue. Refining using microwave energy is thought to be one way to solve these decarbonization issues, and many studies are underway. In this research, experiments were conducted using 5.8 GHz microwaves, which is different from the commonly used 2.45 GHz microwave process^[1]. Various frequency dependencies have been reported in microwave heating due to the selection of heating elements depending on the microwave frequency. Microwave heating was performed by inserting the sample at the maximum electric field position using the single-mode resonator method. The process of extracting ferronickel alloy was carried out using microwave irradiation. Power variations were applied to observe the effect of microwave power on the formation of ferronickel alloys. The results of the analysis using the XRD (X-Ray Diffractometer) showed that at a power of 75 watts and 100 watts the ferronickel alloy formed well in the form of ferronickel oxide alloy. As shown in fig. 1, the increase in microwave power caused a decrease in the mass of the laterite ore, which indicates the reaction of the formation of several compounds that begins with the loss of water content in laterite ore minerals. SEM-EDX (Scanning Electron Microscopy-Energy Dispersive X-Ray) analysis was performed to determine the nickel grade obtained after the application of microwave power. In addition, SEM-EDX data is used to determine the amount of nickel successfully extracted from the laterite ore.

Reference: [1] Weiquan Ma, et al., Journal of Microwave Power and Electromagnetic Energy, (2019).

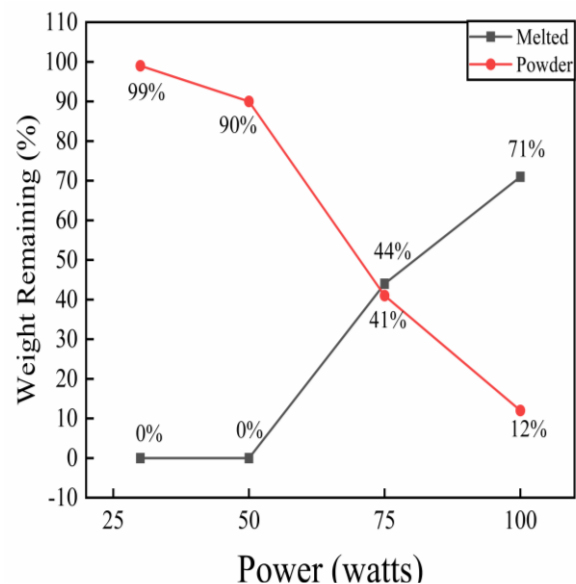


Fig. 1. Application of microwave power in 10 minutes caused the decreasing of powder weight and increasing of melted weight in ore