Simulation Study of the Microwave Heating of the Hematite and Coal Mixture

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Abstract : Temperature distribution in the hematite ore mixed with 7.5% coal was predicted by solving a 1-D heat conduction equation using an implicit finite difference approach. In this work, it was considered a square slab of 20 cm x 20 cm, which assumed the coal to be uniformly mixed with hematite ore. It was solved the equations with the use of MATLAB 2018a software. Heat transfer effects in this 1D dimensional slab convective and the radiative boundary conditions are also considered. Temperature distribution obtained inside hematite slab by considering microwave heating time, thermal conductivity, heat capacity, carbon percentage, sample dimensions, and many other factors such as penetration depth, permittivity, and permeability of coal and hematite ore mixtures. The resulting temperature profile can be used as a guiding tool for optimizing the microwave-assisted carbothermal reduction process of hematite slab was extended to other dimensions as well, viz., 1 cm x 1 cm, 5 cm x 5 cm, 10 cm x 10 cm, 20 cm x 20 cm. The model predictions are in good agreement with experimental results.

Keywords : hematite ore, coal, microwave processing, heat transfer, implicit method, temperature distribution
Conference Title : ICMMIS 2022 : International Conference on Metal Material, Iron and Steel
Conference Location : Paris, France
Conference Dates : November 14-15, 2022