

UTILISATION OF END-OF-LIFE PLASTICS AS REDUCTANT FOR THE PRODUCTION OF METALLIC COPPER FROM TENORITE (CuO) ORE

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Abstract

The production of metallic copper from Tenorite (CuO) ore using carbonaceous material generated from end-of-life high density polyethylene (HDPE) has been investigated through experiments conducted in a domestic microwave oven and a laboratory-scale horizontal tube furnace (HTF) coupled with an infrared (IR) gas analyser. Composite pellets of reagent-grade Tenorite ore with HDPE at carbon-oxygen ratios of 1.5, 2.0 and 2.5 were irradiated in a domestic microwave oven (AKAI brand, 700 watts and 2.5 GHz frequency) for 10 minutes. Reaction products were submitted for SEM/EDS analyses. Cylindrical pellets of the mixture were also rapidly heated at 1100°C under pure argon gas, and off-gas was continuously measured by an online infrared gas analyser for CO and CO₂. The rate and extent of reduction of CuO are highest at a C/O ratio of 2.0. Results from microwave irradiation confirm that CuO-HDPE blends can absorb sufficient microwave radiation for nearly complete reduction of CuO to Cu, evidenced by numerous spherical copper particles in the reduced pellet. This work demonstrates that waste plastics can serve as effective industrial reductants for copper ore processing.

Keywords: End-of-Life Plastics, Tenorite ore, CuO, Extent of reduction, C/O ratio.

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