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The Correlation between Palm Shell Char Properties and the Production of Metallic Iron in EAF Steelmaking Slag Reduction Reaction

Abstract

Palm shells wastes generated from oil palm processing are in abundance in landfills every year thereby posing environmental problems. Enormous amount of wastes generated by agro-industry has previously studied as carbon source in steelmaking hence providing solution to environmental problems. This paper studied on the conversion of palm shell waste into carbon material via physical and chemical activation method for metallic iron extraction. Physical char was prepared by pyrolyzed in nitrogen atmosphere at 450°C while chemical char was impregnated in phosphoric acid before pyrolyzed. Composite pellets of EAF slag (43.18 %Fe2O3) with physical and chemical char were rapidly heated at temperature 1550°C within 20 minutes under argon flow. All reduced samples were analyzed on the weight loss, degree of reduction, iron recovery and phase analysis using X-ray diffraction (XRD). The results indicated that chemical/slag showed higher weight loss (38.8%) and excellent degree of reduction (29.94%) compared to physical/slag due to higher volatile matter content (9.8%) and larger surface area (562.14m2/g). It was found that the production of metallic iron particles after the reduction process and indicated that chemical char achieved higher iron recovery (15.48%) compared to physical char due to higher total carbon content (60.28%). XRD and Rietveld refinement analysis confirmed that the iron phase was a major component in metallic iron particles for physical/slag and chemical/slag samples. This elucidated that the iron oxides in EAF slag was completely reduced into iron by using palm shell chars as carbon materials. This finding indicates that palm shell chars potentially act as carbon materials in steelmaking applications according to their good characteristics.