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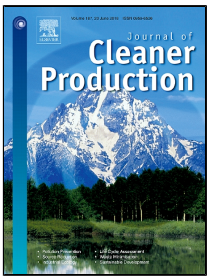

Transformation of Waste Toner to Iron using E-waste Plastics as a Carbon Resource

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Transformation of Waste Toner to Iron using E-waste Plastics as a Carbon Resource

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Abstract:

Plastics from electronic waste pose significant environmental and ecological threats due to several reasons, including, poor recyclability, complex nature, and significant increases in volumes of e-waste. In the present study, plastics from end-of-life printers were utilized as an alternative source of carbon in low-temperature reduction of iron oxide. As-received mixed plastic waste was characterized using several analytical tools and styrene acrylonitrile (SAN) was found to be the dominant plastic in the waste. Thermogravimetric analysis (TGA) was used to determine degradation kinetics of SAN plastics. SAN was subjected to thermal treatment in a horizontal tube furnace at 900 ^{o}C to evaluate the gaseous and solid products obtained and assess its suitability as a carbonaceous resource. In the present study, waste toner powder was utilized as a source of iron oxide. A heated platen press was employed to pelletize raw SAN and waste toner powder, which were then subjected to thermal transformation at 900 and 1100 ^{o}C. X-ray diffraction (XRD) and scanning electron microscopy (SEM) analyses on the reduced samples indicate the partial reduction of iron oxide to metallic iron. This suggests that the SAN plastics from end-of-life printers can potentially be used as a partial replacement for conventional and non-renewable carbonaceous materials in iron oxide reduction, enabling cleaner and sustainable production of iron.

Keywords: sustainability; e-waste plastics; carbon resource; waste toner; iron oxide reduction; thermal transformation