Nehal Ali Erfan Abdelwahab, J Material Sci Eng 2015, 4:5
http://dx.doi.org/10.4172/2169-0022.C1.028

OMICS International
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4th International Conference and Exhibition on
Materials Science & Engineering
September 14-16, 2015 Orlando, USA

Characterization of magnetic glass ceramics derived from iron oxides bearing rolling mill scales wastes

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The objective of the present investigation is to study the feasibility of conversion of steel rolling mill scales into soft and hard magnetic glass ceramics. Up to 5% of steel is lost with the scale during hot rolling operation. This waste contains 69-72% of iron in the form of oxides. However, its recycling is challenging due to the presence of up to 20% of oil and 10% of water. To synthesize soft magnetic glass ceramics (SMGC) and hard magnetic glass ceramics (HMGC), 65 wt% and 37 wt%, respectively of Rolling Scales Waste (RSW) were used. Differential Thermal Analysis (DTA) revealed two broad exothermic peaks in SMGC samples at 90°C and 639°C and, one peak at 516°C for HMGC. X-Ray Diffraction (XRD) showed that the major detectable peaks belong to Zn-ferrite ($ZnFe_2O_4$) and Hematite (Fe_2O_3) for SMGC. Alternatively, Ba-hexaferrite ($BaFe_{12}O_{19}$) and Fe_2O_3 are the detected phases in HMGC samples. Transmission electron microscopy (TEM) revealed crystallization of nanosize particles for SMGC (131-166 nm) and HMGC (24-34 nm) after heat treatment. Vibrating scanning magnetometer revealed an increase in saturation magnetization from 18 emu/g for RSW to 66 emu/g for SMGC and 19 emu/g for HMGC. Using rolling mill scales waste we were able to synthesize soft and hard magnetic glass ceramics with magnetic phase content of 72.2 wt%, exceeding the theoretical amount of 45 wt%.

Biography

Nehal Ali Erfan Abdelwahab has completed her Master's degree from Minia University in Egypt. She spent two years working for her PhD in the National Research Center in Cairo and now she is completing her PhD study in East Carolina University.

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