

Red Soil in Northern Sri Lanka is a Natural Magnetic Ceramic?

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Abstract

The scope of the studies is to explore electric and magnetic properties of Fe³⁺ ion rich red soils in Northern Sri Lanka. Six samples were collected at different locations in Northern Jaffna peninsula, Sri Lanka for this investigation. Reported studies involve current-voltage (IV) measurements at room temperature of fresh, moisture-freed (115 °C at 48 hrs), and annealed (1000 °C at half an hour) conditions. At the fresh condition moisture dominates and is responsible for much of its transport properties. However, we are reporting that Fe³⁺ ions are more responsible for the electrical transport properties in the moisture-freed and annealed conditions. Even though moisture-freed and annealed samples follow linear IV behaviour the quantitative values suggest that the samples are very close to insulators (or semiconductor-insulator boundary). High field magnetization measurements up to 7 T at 1.8 K show all the samples reach the saturation moments around at 2.5 T, where the behaviour is very much similar to ferromagnetic materials. The highest saturated moment reported is 6 emu/mole Fe³⁺ and the lowest is 3 emu/mole Fe³⁺. Also, we are presenting the magnetic susceptibility-temperature ($\chi(T)$) measurements from room temperature (300 K) down to 1.8 K, which suggest that critical temperature is around $T_c \sim 45$ K. Perhaps, the red-soil be a natural magnetic ceramic.

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