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Structural, microstructural, electrical and magnetic characterization of $Gd_{2-x}M_xRu_2O_7$, where M = La or Ho

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Abstract – Magnetic frustration has been object of intensive studies in recent years. Such characteristic is exhibited by the pyrochlores. In this work, ruthenium pyrochlores, $Gd_{2-x}M_xRu_2O_7$, were prepared by the traditional solid-state reaction method, where M = La or Ho. A systematic study of the electrical and magnetic properties of such compounds was conducted varying the Lanthanum and Holmium content in the $Gd_2Ru_2O_7$ matrix.

Compounds, which present pyrochlore structure $R_2B_2O_7$ (R = rare earth and B is a transition metal), exhibit a wide variety of electrical and magnetic properties [1]. The electrical properties can change from highly insulate to metal-poor behavior. The most remarkable magnetic characteristic is the spin-glass transition with apparent absence of magnetic long-range order [2]. In particular, the material studied here has ruthenium and gadolinium occupying the B and R sites, respectively. Ruthenium pyrochlore structure has metal-semiconductor transition depending on the amount of oxygen vacancies and conditions of synthesis [3].

The samples were prepared by solid-state reaction method. Stoichiometric amount of Gd_2O_3, RuO_2, La_2O_3 and HoO_2 were mixed and submitted to heat treatment between 1000 - 1100°C for 96 h with intermediate regrindings. The X-rays diffractograms showed low amounts of impurity phases (Fig.1). The electrical properties were analyzed by resistance as a function of temperature, revealing a metal-insulation transition (Fig.2). The magnetic measurements will be conducted using a MPMS (Magnetic Property Measurement System) Magnetometer by Quantum Design via measurements of DC magnetization vs. temperature and magnetic field. We believed that the doped system can induced a superconducting behavior.

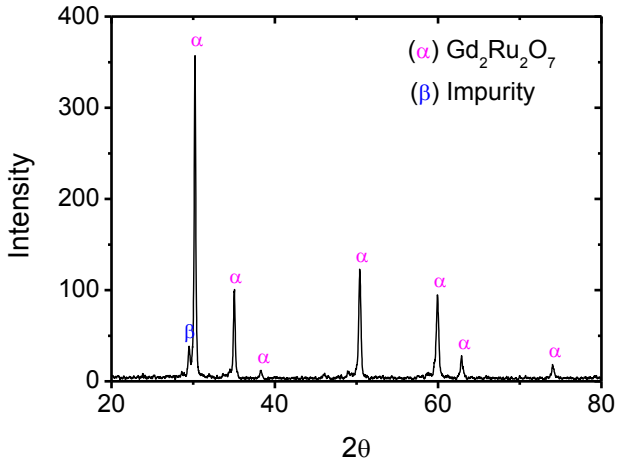

Fig.1 - X-rays diffractogram.

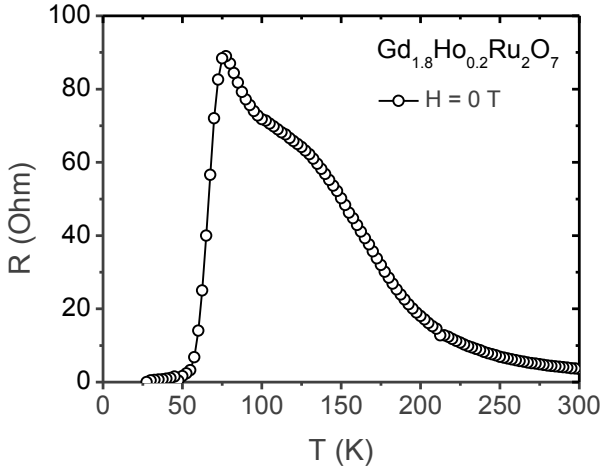

Fig.2 - Resistance vs. Temperature.

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