Electrical transport in oxidized iron thin films JOLANTA STANKIEWICZ, JUAN BARTOLOMÉ, ICMA, CSIC-Universidad de Zaragoza, FÉLIX JIMÉNEZ-VILLACORTA, CARLOS PRIETO, ICMM, CSIC — We report results of electrical resistivity, Hall effect and anisotropic magnetoresistance (AMR) measurements performed on thin films (~ 50 nm) of oxidized iron in the temperature range from 10 to 300 K, and in magnetic fields up to 0.6 T. The films were sputtered on naturally oxidized Si(100) substrates whose deposition temperature $T_s$ can be varied between 170 and 300 K. Samples were oxidized at room temperature for 30 minutes, and subsequently capped with a SiO$_2$ layer in order to prevent further oxidation. By changing $T_s$ during the growth process we can control the size and shape of crystalline grains in these films. We find that the residual resistivity, carrier concentration, coercive field $H_c$ as well as the magnetoresistance of the films are strongly affected by growth conditions, particularly by the substrate temperature. All measured samples are metallic with a room temperature electron concentration of about $2 \times 10^{21}$ cm$^{-3}$. As $T_s$ increases, the resistivity at $T$=10 K decreases from $\approx 400$ $\mu$Ωcm (for $T_s$=170 K) to $\approx 40$ $\mu$Ωcm (for $T_s$=300 K). The low-temperature coercive field, obtained from AMR data, also decreases from $\approx 500$ to $\approx 300$ Oe as $T_s$ increases. At $T$=300 K, $H_c \approx 100$ Oe for all values of $T_s$. AMR values increase with increasing $T_s$. We find the room-temperature planar Hall effect ratio of about 15% in the films grown at $T_s \geq 250$ K.

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