Nanocomposites and Nanomaterials

Magnetoresistivity of nanometric films based on iron and chromium oxides

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At present the thin nanometric films based on oxides causes the great interest owing to their multifunctionality and possibility to use them as multiparametric sensors. The thin nanometric films based on nonstoihiometric iron Fe_2O_{3-X} ($0 \le x \le 1$) and chromium oxides $Cr_{3-X}O_{3-Y}$ ($0 \le x \le 2$; $0 \le y \le 2$) & also multilayer system from these interlaced materials $Fe_2O_{3-Y}/Cr_{3-X}O_{3-Y}/Fe_2O_{3-Y}/Cr_{3-X}O_{3-Y}$ ($0 \le x \le 2$; $0 \le y \le 2$) were studied. These films were deposited on the Si <100> substrate by RPLD method by UV KrF laser ($\lambda = 248$ нм $\tau = 25$ ns) were synthesized [1]. The X-ray analisis (XRD) of the samples confirms the presence of polycrystalline phases Cr_2O_3 and CrO_3. The thickness of the films d lies from 50 to 80 nm.

In the dependence of magnetoresistivity ($\rho(B)$, 0÷0.7 T, 293K) of these thin films the in transversely geometry two characteristic regions are founded. In these regions the dependence of magnetoresistivity has different behavior. Till 0.1 T, it is "switching region", where $\Delta\rho(B)/\rho_0 = 50\%$, further it is "region of hysteresis".

The samples of nonstoihiometric nanometric oxide films demonstrate photoelectric properties. On this samples the kinetics of stationary ($\lambda = 470$ nm) and spectral dependences (500 ÷ 1200 nm) of photoconductivity were observed. The increase of stationary photoconductivity very good fitted by exponent with two characteristic times ($t_1 = 0.51$ min and $t_2 = 9.03$ min). Also the relaxation curve fitted by exponential decay but there are different characteristic times ($t_3 = 0.92$ min and $t_4 = 19.05$ min). The spectra of the photoconductivity (0.5 ÷1.2 μm) of multilayer samples are more complex then summary spectra of one-layer samples.

1. *Mulenko S.A., Gorbachuk N.T., Stefan N.* Laser synthesis of nanometric iron oxide films with high Seebeck coefficient and high thermoelectric figure of merit// Lasers Manuf. Mater. Process -2014-**1,**-P. 21-35.