CVD SYNTHESIS OF POLYCRYSTALLINE MAGNETITE THIN FILMS: STRUCTURAL, MAGNETIC, AND MAGNETOTRANSPORT PROPERTIES

R. Mantovan[1]*, A. Lamperti[1], M. Georgieva[1], and M. Fanciulli[1,2]

[1] Laboratorio Nazionale MDM CNR-INFM, Via C. Olivetti 2, 20041 Agrate Brianza (MI), Italy
[2] Dipartimento di Scienza dei Materiali, Università di Milano Bicocca, Milano, Italy

* Corresponding Author: e-mail: **roberto.mantovan@mdm.infm.it**; Phone:+39 039 603 6540

Magnetite (Fe_3O_4) is predicted to be half metallic at room temperature and it shows the highest Curie temperature among oxides. The use of Fe_3O_4 thin films is therefore attracting for their inclusion into spintronic devices such as magnetic tunnel junctions and magnetoresistive sensors. We have been successful in using the chemical synthesis route for depositing magnetite thin films. The structural, morphological and magnetic properties of the as deposited Fe_3O_4 films have been studied by means of time of flight secondary ion mass spectroscopy, grazing incidence X-ray diffraction, X-ray reflectivity, conversion electron Mössbauer spectroscopy, and superconducting quantum interference device magnetometry. Magnetotransport measurements have been performed up to 1.1 T, showing -2.4% magnetoresistance at room temperature. Resistivity measurements in the 100-300 K temperature range show that the magnetotransport properties of the Fe_3O_4 films are governed by intergranular tunneling of the spin polarized electrons. The spin polarization is predicted to be around -16%. We have investigated the role of atomic-scale structural defects (vacancies) in determining the magnetotransport properties, and a possible route for increasing the magnetoresistance properties of the Fe_3O_4 thin films is underlined. A combined chemical vapour- and atomic layer- deposition process has been adopted for the synthesis of Fe_3O_4/MgO/Co multilayers on Si/SiO_2 substrates. The hysteresis curve of selected multilayers shows two well-distinct switching fields, making promising the synthesis of functional magnetic tunnel junctions based on the proposed multilayered structure.