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Iron oxides/hydroxides magnetic biomaterials for application in electronics and medicine

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Nanosized biogenic iron oxides/hydroxides are promising alternatives for microetoelectronics. They have been used in "*in vivo*" experiments in NMR, for better contrast. The recently developed biotechnology was focused on acquiring new physical data for application in electronics and medicine of the biogenic material obtained due to the metabolism in laboratory conditions of iron-oxidizing bacteria from the genus *Leptothrix.* Powders and coatings on glass samples were under investigation. Analysis of the data collected show that the Fe^{2+} depending from the growth media could transformed into Fe^{3+} or $Fe^{2.5+}$ in the form of two types of oxides/(oxy)hydroxides such as lepidocrocite (ɣ-FeOOH) and magnetite (Fe_3O_4), all with nanostructured morphology. The particle's size (below 30 nm) and crystalline structure of the bioproducts were investigated by XRD, SEM, TEM, Mössbauer and Raman Spectroscopies. The structural deviations are observed in biogenic iron oxides/hydroxides by comparison with the conventional materials. The results further demonstrate that lepidocrocite is the main product of the bacteria's metabolism, both in the film and in the sediment's powder. The formation of Fe_3O_4 passes through intermediate phase – "green rust" reaction and the quantity could be controlled during the preparation. The work report results were based on SQUID measurements on the magnetic properties - M(T) of the biogenic ferroxides. Monodomain particles which are antiferromagnetic - ɣ-FeOOH and ferrimagnetic - Fe_3O_4 were received. For the needle like crystals of lepidocrocite the outer casing deviations were observed which modified the magnetic properties about 50 K. The new biogenic materials showed superparamagnetic behavior and high sensitivity to electromagnetic radiation. The biogenic tubular formation with a single-phase iron oxides/hydroxides inclusions in biogenic matrix was also investigated. Contributions for understanding the structural, magnetic and optical properties are important for fundamental research, but also some suggestions for potential applications in electronics and information technologies are proposed.

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