MAGHEMITE NANOPowDER SYNTHESIZED BY ATMOSPHERIC-PRESSURE MICROWAVE TORCH DISCHARGE USING IRON PENTACARBONYL AS A PRECURSOR

Bohumil DAVID a, Oldřich SCHNEEWEISS a, Naďa PIZÚROVÁ a, Eva ŠANTAVÁ b, Vít KUDRLE c, Petr SYNEK c, and Ondřej JAŠEK c

a CEITEC IPM, Institute of Physics of Materials, AS CR, v.v.i., Žižkova 22, CZ -61662 Brno, Czech Republic, david@ipm.cz, schneew@ipm.cz, pizurova@ipm.cz

b Institute of Physics, AS CR, v.v.i., Na Slovance 2, CZ-18221 Prague, Czech Republic, santava@fzu.cz

c Department of Physical Electronics, Faculty of Science, Masaryk University, Kotlářská 2, CZ -61137 Brno, Czech Republic, kudrle@sci.muni.cz, synek@sci.muni.cz, jasek@sci.muni.cz

Abstract

Microwave torch discharge ignited in Ar at atmospheric pressure has been used for the synthesis of maghemite ß-Fe2O3 nanoparticles. A double-walled nozzle electrode enabled to introduce gases separately: Ar flowed in the central channel, whereas the mixture of H2/O2/Fe(CO)5 was added into the Ar torch discharge through the outer channel. The composition and properties of the synthesized nanopowder were studied by TEM, XRD, Raman and Mössbauer spectroscopies. For magnetic measurements in the range 293–1073 K a vibrating sample magnetometer was used. The measurements of ZFC/FC curves and heat capacity in the range 4–293 K were done on a PPMS Quantum Design device. Only ß-Fe2O3 phase with the mean crystallite size of 20 nm was identified by XRD in the representative sample. The measured Raman spectrum matched well those reported for ß-Fe2O3 powders in the literature. In the Mössbauer transmission spectrum measured at 5 K the two sextets characteristic for ß-Fe2O3 were clearly identified. Structural changes and phase transformations of the nanopowder up to 1073 K are described.

Keywords: microwave discharge, maghemite, Mössbauer spectroscopy, magnetic measurements.