m43.o04

Stability of the Nanocrystalline $LaMnO_{3\pm\delta}$ Under Non-Ambient Conditions

Sophia Petrova[a], Robert Zakharov[a], Boris Gizhevskii[b], Vitaly Pilyugin[b], Viatcheslav Lisin[a]

[a]*Institute of Metallurgy UD RAS,* [b]*Institute of Metal Physics UD RAS, Ekaterinburg, Russia.E-mail: danaus@mail.ru*

Keywords: nanocrystalline materials, redox, X-ray high-temperature powder diffraction

Production of the solid compact nanomaterials is one of the most actual topics in chemistry, physics of condensed matter, and material science nowadays. The main difficulties in producing compact nanomaterials from nanopowder arise from their pressing and following annealing, which may cause an increase of grain size and lack of important features for nanomaterials. Therefore, compact nanocrystalline oxides for the present investigations were produced by a high-pressure torsion method [1,2] well-developed for metals.
Being non-equilibrium metastable systems, nanomaterials are interesting for studying their stability. For this purpose the X-ray diffraction measurements were carried out *in situ* under non-ambient conditions with the help of an automated measuring complex based on a high temperature attachment with a microprocessor regulator of partial oxygen pressure. It allows us to maintain in the closed volume the given values of partial oxygen pressure in the range of $1\text{-}10^{-22}$atm and also to check the processes of oxygen exchange taking place in the sample during heating or cooling. The control is provided by a circulating electrochemical ''pump-sensor'' system assembled on the base of oxygen-conducting solid electrolytes. The constancy of the nanocrystalline $LaMnO_3$ was examined in a wide temperature range (300-1000K) and under different partial oxygen pressures ($1\text{-}10^{-22}$atm). It brought out phase composition of the samples, cation distribution among sublattices, volumetric crystallite size distribution and microstress analysis at different temperatures and partial oxygen pressures. The work was supported by the Federal Agency for Science and Innovations under the contract No.02.434.11.7048 and the Russian Foundation for Fundamental Research, grant No.06-03-32943.

[1] D.I.Tupitsa, V.P. Pilyugin, R.I. Kuznetsov, et al., *Fiz. Met. Metalloved.,* 61, 1986, 325. [2] N.M.Chebotaev, A. Gedanken, B.A.Gizhevskii et al., *Doklady Chemistry*, 405, 2, 2005, 247.

m43.o05

In-situ X-ray diffraction measurements for monitoring carbide and silicide phase formation.

W.P. Leroy[a], D. Deduytsche[a], C. Detavernier[a], R.L. Van Meirhaeghe[a], D. Poelman[a], C. Lavoie[b],

[a] *Vakgroep Vaste-Stofwetenschappen, Universiteit Gent, Krijgslaan 281/S1, B-9000 Gent, Belgium,* [b] *IBM T.J. Watson Research Center, Yorktown Heights, New York 10598, USAE-mail: wouter.leroy@ugent.be*

Keywords: in situ dynamic XRD, silicides, carbides

Metal-silicon compounds (silicides) are widely used for contacting devices on Si-substrates. By analogy, carbides are potentially useful to contact electronic devices fabricated on carbon-containing semiconductors (SiC, SiGeC, diamond, carbon nanotubes, ...). In this work, the formation of silicides and carbides was studied using in-situ x-ray diffraction during annealing.
Thin metal layers (thicknesses from 5 to 30 nm) of various transition metals were deposited on a variety of substrates (Si(100), Si(111), SOI, amorphous Si, and amorphous carbon). Different capping layers (silicon, carbon, tungsten and tantalum) were deposited on some of the samples to investigate the effectiveness of the capping material in preventing oxidation of the metal during reaction.
During the solid-state reaction, the phase formation, resistivity and roughness were characterized using in-situ x-ray diffraction, sheet resistance and laser light scattering measurements. We will report on the formation temperature, resistivity, thermal stability and the sensitivity to oxidation of various silicide and carbide phases. These characteristic properties can be used as selection criteria to determine the most promising candidates for contacting carbon containing semiconductors, or to improve our knowledge of established contact materials to Si.