"Nanocomposites and nanomaterials"

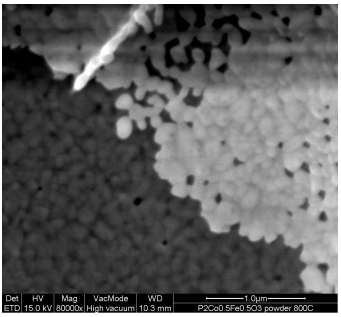
Sol-gel prepared nanoparticles of new mixed praseodymium cobaltites-ferrites

I.V. Lutsyuk[1], Ya.I. Vakhula[1], O.V. Pekinchak[1], Yu. Prots[2], W. Carrillo-Cabrera[2], L.O. Vasylechko[1]

[1]Lviv Polytechnic National University, 12 Bandera Street, 79013 Lviv, Ukraine
E-mail: olgakharko@ukr.net

[2] Max-Planck-Institut für Chemische Physik fester Stoffe, Nöthnitzer Str. 40, 01187 Dresden, Germany.

Nanocrystalline powders of $PrCo_{1x}Fe_xO_3$ (x = 0.1, 0.3, 0.5, 0.7 and 0.9) were prepared by sol-gel citrate method. Crystalline $Pr(NO_3)_3{\cdot}6H_2O$, $Co(NO_3)_2{\cdot}6H_2O$, $Fe(NO_3)_3{\cdot}9H_2O$ and a citric acid (CC) were dissolved in water and mixed in the molar ratio of $n(Pr^{3+}) : n(Co^{2+}) : n(Fe^{3+}) : n(CC) = 1 : (1\text{-}x) : x : 4$ according to the $PrCo_{1x}Fe_xO_3$ nominal compositions. Prepared solutions were gelled at ~90 ºC and subsequently treated at the temperatures of 700 and 800 ºC for 2 h. Thus, two series of the samples were obtained. Both laboratory X-ray diffraction (XRD) data and high-resolution synchrotron powder diffraction examinations performed at ID22 beamline of ESRF revealed formation of pure perovskite structures in both $PrCo_{1x}Fe_xO_3$ series. No traces of the parasitic phases were detected. Refined values of the lattice parameters prove the formation of continuous solid solution with orthorhombic perovskite structure (sp. group *Pbnm*) in $PrCoO_3$–$PrFeO_3$ pseudobinary system.



Average grain size estimated from the analysis of XRD line broadening was in the limit of 50150 nm, depending on $PrCo_{1x}Fe_xO_3$ composition. Scanning electron microscopy of $PrCo_{0.5}Fe_{0.5}O_3$ sample prepared at 800 ºC (figure) revealed a lacy morphology of the powder consisting of irregular shaped 60−100 nm nanoparticles.

***Acknowledgments**: The work was supported in parts by the Ukrainian Ministry of Education and Sciences (Project "KMON") and ICDD Grant-in-Aid program. High-resolution X-ray synchrotron powder diffraction measurements were carried out during beamtime allocated to the ESRF Experiment MA-2320.*