Moscow International Symposium on Magnetism

1 – 5 July 2017

Book of Abstracts

M.V. Lomonosov Moscow State University, Faculty of Physics

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THERMODYNAMIC PROPERTIES OF $Fe_7(PO_4)_6$ AND $Na_xFe_7(PO_4)_6$

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The $Fe_7(PO_4)_6$ [1] represents a rare case of parent compound of widespread structure type with general formula $Me_3^{2+}Me_4^{3+}(XO_4)_6$ (where Me − first row transition metal, Mg; X − P, V, As, Mo or In) with poorly investigated physical properties. Introduction of transition metals, i.e. manganese, cobalt, nickel and copper into $Fe_7(PO_4)_6$ structure results in preferable occupation of iron positions by Me^{2+} ions so that total formula transforms into $Mn_2^{2+}Fe^{2+}Fe_4^{3+}(PO_4)_6$, $Co_3^{2+}Fe_4^{3+}(PO_4)_6$, $Ni_3^{2+}Fe_4^{3+}(PO_4)_6$ and $Cu_{3-x}^{2+}Fe_{4+x}^{3+}(PO_4)_6$. Available information about their magnetic properties is limited to antiferromagnetic order formation at T_N = 47 K in nickel–doped compound. Trivalent positions can be occupied by titanium (Me − Mg, Cr, Mn, Fe, Co, Ni, Cu, Zn), vanadium (Me − Mg, Cr, Mn, Fe, Co, Ni, Zn), chromium (Me − Mg, Cr, Mn, Fe, Co, Cu, Zn) or indium (Me − Mg, Co, Ni, Zn). The magnesium comprising compounds are mostly paramagnets. The combinations of transition metals with vanadium experience antiferromagnetic ordering at low temperatures of about 12 – 15 K. Another route for chemical modifications of $Fe_7(PO_4)_6$ structure relates with introduction of alkali metals ions, i.e. Na^+, into the crystal structure. In our work we focused on parent compound $Fe_7(PO_4)_6$, which is isotypic with mineral vanadate howardevansite $NaCuFe_2(VO_4)_3$, and its counterpart compound doped with sodium metals ions, $Na_xFe_7(PO_4)_6$. Here we present basic thermodynamic and magnetic properties of these compounds and their primary characterization.

[1] Yu.A. Gorbunov, B.A. Maksimov, Yu.K. Kabalov, A.N. Ivashchenko, O.K. Mel'nikov; N.V. Belov, *Doklady Akademii Nauk SSSR,* **254** (1980) 873-876.