Mn doped $BiNbO_4$ ceramics: phase transitions, magnetic properties, NEXAFS and EPR spectra

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Magnetic susceptibility, NEXAFS and ESR of solid solutions $BiNb_{1-x}Mn_xO_{4-\delta}$ in triclinic and orthorhombic modifications have been studied. The reversibility of the phase transition from the high-temperature triclinic modification to the orthorhombic one has been revealed by means of magnetic dilution and X-ray phase analysis on the example of polycrystalline samples of the solid solutions $BiNb_{1-x}Mn_xO_{4-\delta}$ [1]. The manganese-containing $BiNbO_4$ solid solutions were obtained at $x \leq 0.06$. The ESR spectra of solid solutions in triclinic modification revealed sextet structure of Mn(II) ions with 8.4 mT splitting and some features at g = 3.80 and 1.47, and a broad diffuse band with g ~ 2.2 having a sextet with 8–9 mT splitting and g = 2.0 against its background. The parameters of exchange interactions in dimers and the distribution of manganese atoms (II), (III) and (IV) of $BiNb_{1-x}Mn_xO_{4-\delta}$ in triclinic and orthorhombic modifications have been calculated depending on the concentrations of the solid solutions. The solid solutions $BiNb_{1-x}Mn_xO_{4-\delta}$ as well as iron oxides MnO, Mn_2O_3 and MnO_2 were studied by the NEXAFS spectroscopy in order to determine the degrees of oxidation of iron atoms. The analysis of the NEXAFS Mn2p-spectra of manganese-containing solid solutions and oxides revealed that the studied Mn atoms were mainly in the (II), (IV) oxidation state.

References

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