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Lattice parameters for Ni–Mn disordered alloys by EXAFS

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Introduction

Ni-Mn alloys are presented the system with competitive exchange interaction. Magnetic behavior of these alloys is determined by atomic short range order [1,2]. There exists a hypothesis about relation between magnetic and atomic states [1]. For example, $Ni_{80}Mn_{20}$ solid state solution is ferromagnetic alloy, $Ni_{50}Mn_{50}$ solid state solution is antiferromagnetic one. In the intermediate region the magnetic state should be changed from ferromagnetic to antiferromagnetic state and depend on concentration Mn in alloys.

Experimental details

All samples of Ni–Mn solid state solutions were prepared by plastic deformation method from pure Ni and Mn powders in Institute of metal physics RAS (Ekaterinburg).

The K-edge absorption spectra for Ni and Mn were recorded in transmission mode at BL12C at Photon Factory in Tsukuba. A Si(111) double crystal monochromator was used. The storage ring was operated at 2.5 GeV and the ring current was 120–150 mA. EXAFS–spectra were obtained from the raw absorption data using by preliminary processing [3].To determine interatomic distances, we applied the algorithm of bond length determination [4].

Results and discussion

Results obtained by EXAFS analysis allow to conclude:

1. All Ni_xMn_{100-x} disordered alloys (x=95–5 at. %) have FCC lattice similar to pure Ni.
2. The dependence of lattice constants from Ni concentration has nonmonotonic behavior in comparison with Vegard law (see Fig. 1).

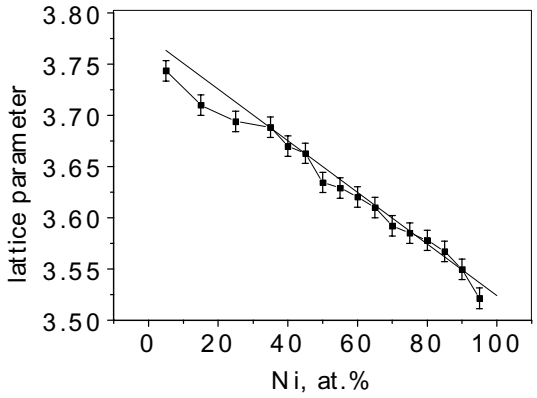

Fig. 1 Ni concentration dependence lattice parameter for Ni–Mn solid state solutions Solid line – Vegard law, solid line with square – lattice parameter, obtained from EXAFS–analysis.

Reference

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