Electrical and magnetic properties as well as crystal and electronic structure of non-stoichiometric $DyNi_2Mn_x$ compounds

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The electrical and magnetic properties as well as the crystal and electronic structure were studied in $DyNi_2Mn_x$ ($0 \leq x \leq 1.25$) alloys. It was found that the alloys crystallize in a cubic $MgCu_2$ Laves phase structure, in spite of the R to 3d-metal ratio changing from 1:2 to 1:3.25. The binary $DyNi_2$ compound is characterized by a low temperature of magnetic ordering, $T_C = 35$ K, since the 3d-band is almost filled by the valence electrons of Dy. The ordering temperature increases very sharply with the addition of Mn, reaches maximum value of 113 K at $x = 0.5$ and then slightly decreases. A monotonous decrease of the magnetization and the magnetostriction and an increase of the coercivity are observed with increasing Mn content. The resistivity also varies with increasing x reflecting the changes in the conductivity band. The XPS results show an increase of Mn 3d-states close to the Fermi level. A comparison of the valence band spectra taken at the resonance and non resonance excitations made it possible to identify Mn 3d-, Ni 3d-, Dy 4f-related features in the valence band. This work was partly supported by the Austrian Academy of Sciences and by the Russian Foundation for Basic Research (Grant Nos 11-02-01221; 10-02-96019).