# MÖSSBAUER EFFECT STUDIES OF $Dy(Fe_{0.7-x}Ni_xCo_{0.6})_2$

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The heavy rare earth (R) - transition metal (M) ferrimagnets $RM_2$, including substituted ferrimagnets, have been widely studied for both their fundamental interest and practical applications [1,2]. The ferrimagnetism of the $RM_2$ compounds results from the coexistence of 4f(5d) and 3d magnetism [3]. The present work aim was the effect of the substitution of Fe with Ni in the $Dy(Fe_{0.7}Co_{0.3})_2$ compound (Fe/Ni substitution introduces additional 3d electrons). The studies were performed using Mössbauer effect technique and the hyperfine interaction parameters were determined in the $Dy(Fe_{0.7-x}Ni_x\ Co_{0.3})_2$ series.

The $Dy(Fe_{0.7-x}Ni_x\ Co_{0.3})_2$ ($x$ = 0.0-0.7) alloys have cubic, Fd3m, $MgCu_2$-type (C15) crystal structure [4]. The measurements were performed at 4.2K on polycrystalline samples using a standard transmission technique with a source of $^{57}$Co in Rh. The collected $^{57}$Fe Mössbauer spectra present complicated pattern (Fig. 1).

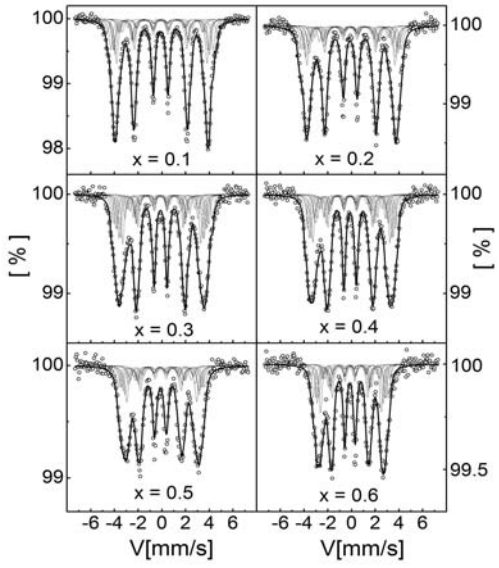


*Fig. 1. $^{57}$Fe Mössbauer effect spectra of the $Dy(Fe_{0.7-x}Ni_x\ Co_{0.3})_2$ intermetallics (4.2K).*

The spectra are composed of a number of subspectra and this complexity arises from the different nearest neighborhoods of the observed Fe-atoms resulting from Fe/Ni substitution. Each Fe, Ni, Co nearest neighbor surrounding introduces its own subspectrum and thus its own set of hyperfine interaction parameters. The problems in determining the number of nearest neighbour surroundings, the number of subspectra, the probabilities of the particular subspectra and the fitting procedure of the spectra in the case of three elements, with randomly distributed atoms, in the transition metal sublattice, is analogous for that for other intermetallic series [5].

The average values of the hyperfine interaction parameters at 4.2K, estimated from the fitting procedure i.e., the isomer shift IS (with respect to pure iron metal, at 300K), the magnetic hyperfine field $\mu_0H_{hf}$ and the quadrupole interaction parameter QS have been determined for seven equidistant $x$ values (Fig. 2).

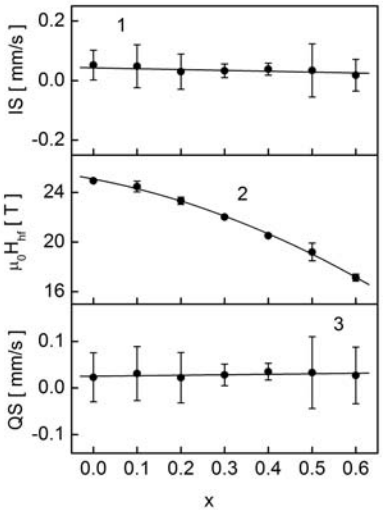


*Fig. 2. Hyperfine interaction parameters of the $Dy(Fe_{0.7-x}Ni_x\ Co_{0.3})_2$.*

The isomer shift decreases with $x$ and experimental points can be described by linear equation: $IS(x)=(-0.028x+0.042)$ mm/s (Fig. 2.1). The magnetic hyperfine field $\mu_0H_{hf}$ equals 24.93(17) T for $Dy(Fe_{0.7}Co_{0.3})_2$ and decreases with increasing Ni content $x$. The experimental points tally well with the formula: $\mu_0H_{hf}(x)=(-10.75x^2-6.71x+25.07)$ T (Fig. 2.2). The quadrupole interaction parameter increases slightly with $x$ and were fitted with the formula: $QS(x)=(0.010x+0.045)$ mm/s (Fig. 2.3)

**References**

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