^{59}Co NMR study of nanocrystallization process in Co-rich HITPERM $(Fe_{0.25}Co_{0.75})_{81}Nb_7B_{12}$ alloy.

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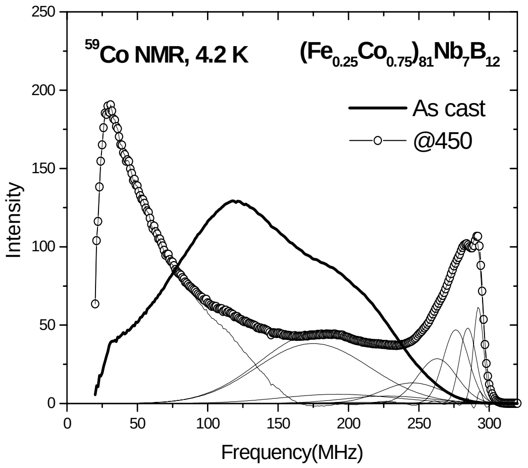
Nanocrystalline FeCoNbB alloys prepared by a devitrification of the melt-spun amorphous precursor belong to the HITPERM-type of soft magnetic materials. We have used ^{59}Co NMR spectroscopy to monitor structural modification of the as-quenched $(Fe_{0.25}Co_{0.75})_{81}Nb_7B_{12}$ amorphous ribbon subjected to heat treatment for 1 h at 450, 500 and 550°C. The ^{59}Co hyperfine field distribution for the as-cast amorphous ribbon (shown in Fig.), exhibits a bimodal shape, which is in contrast to our previous study in Zr based HITPERM alloys, where only one broad line has been observed [1]. The observed hyperfine field distribution reveals the presence of two types of Co local environments in Nb containing alloy. The two maxima of spectrum intensity at around 120 MHz and 200 MHz are assigned to Co atoms located in Nb rich regions and Nb poor regions, respectively. The subsequent heat treatment of the amorphous ribbon causes a very strong modification of ^{59}Co NMR spectra as shown in Fig. The observed drop of the intensity in the intermediate frequency range characteristic for the amorphous state is accompanied by two new spectrum components located at low and high frequencies. The high frequency component extending from 150 MHz up 300 MHz, with a characteristic satellite structure due to different nearest neighbor environments of Co, is a signature of the formation of B2 ordered CoFe nanocrystals. A low frequency component exhibiting a maximum around 30 MHz is attributed to the remaining amorphous matrix. A drastic shift of this maximum towards lower frequency, compared to the parent amorphous material, is attributed to the enrichment of the amorphous residual matrix by Nb and B atoms due to nanocrystallization. The analysis of the nanocrystalline spectrum component in frames of the structural model developed for B2 ordered CoFe alloys [2] (see the spectrum decomposition shown in Fig.) reveals that the Fe content in the grains is higher than that corresponding to the nominal alloy composition. This enrichment shows a slight tendency to decrease with an increase of the heat treatment temperature.



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