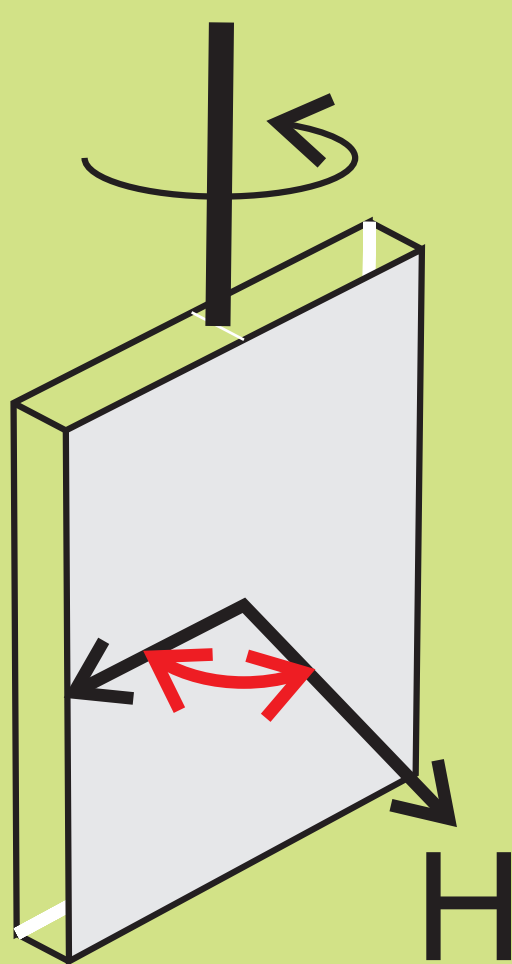
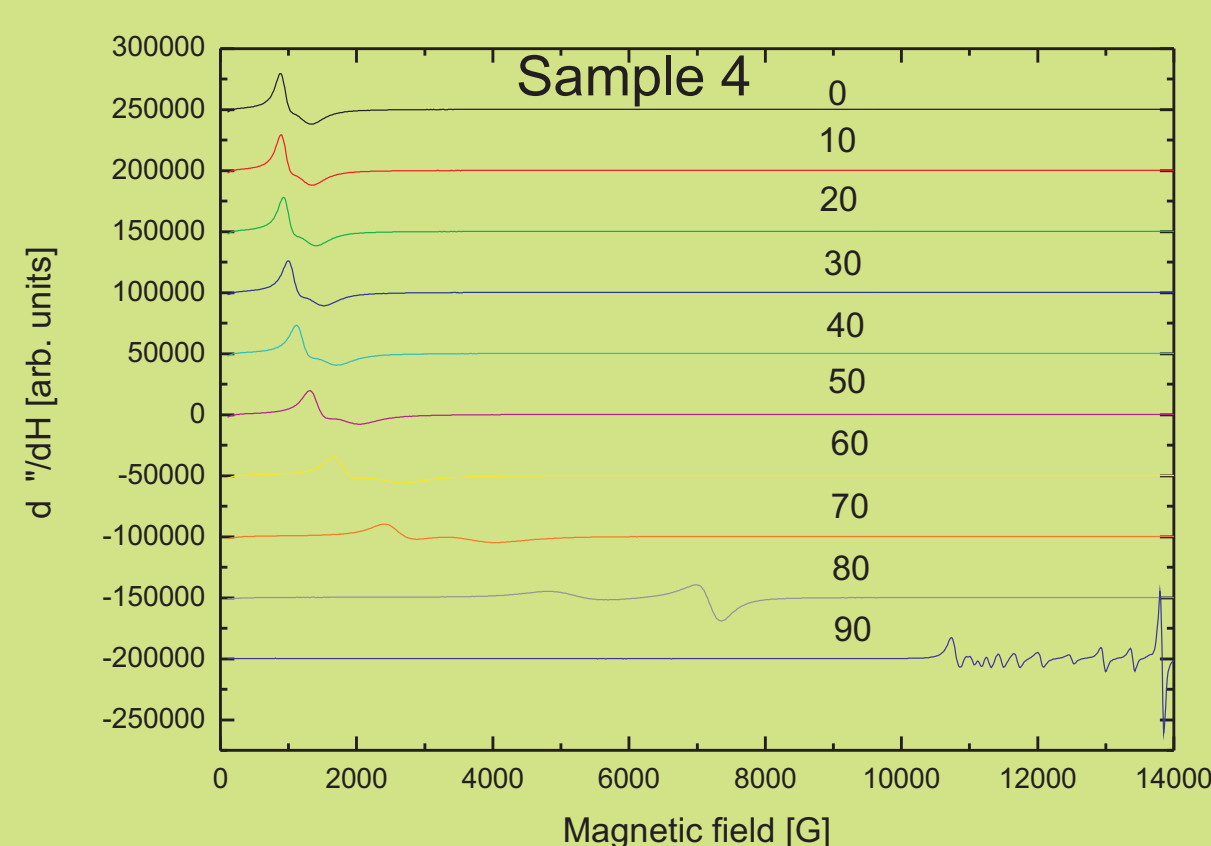
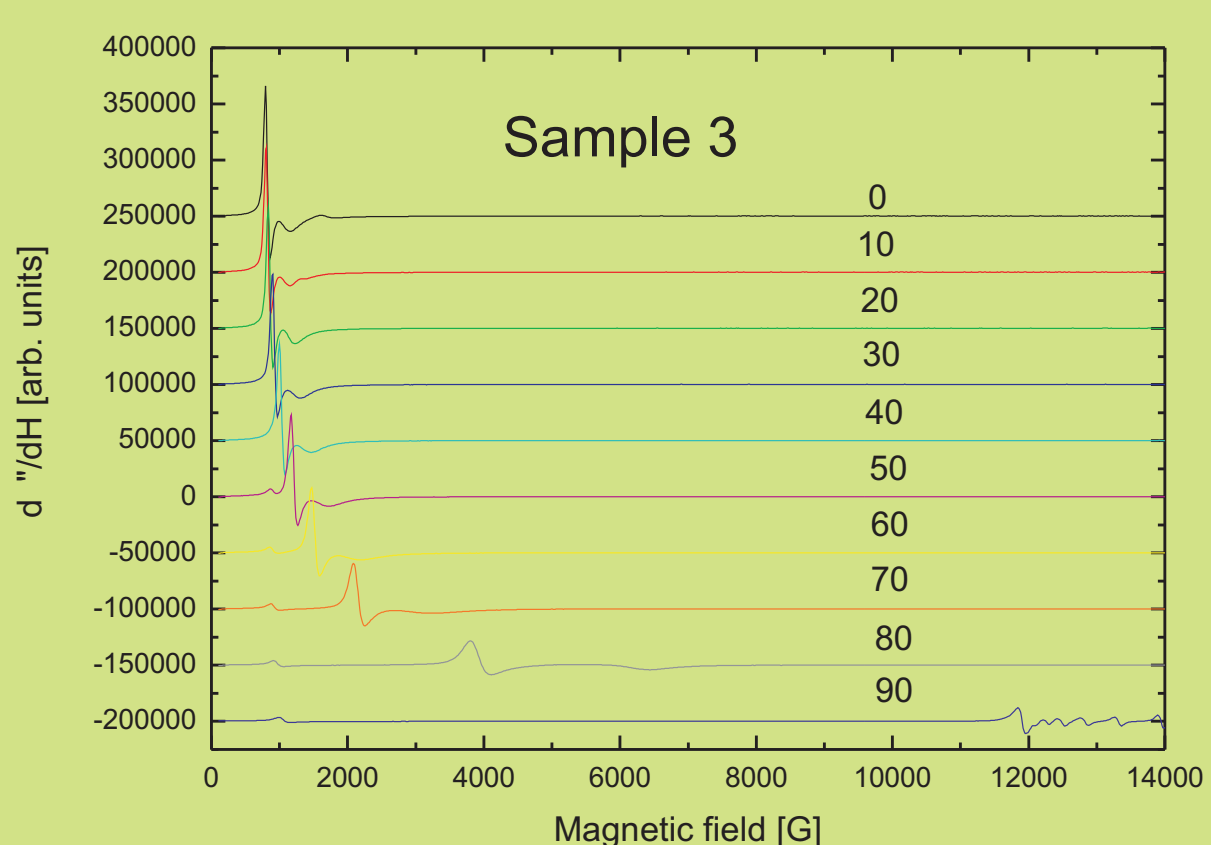
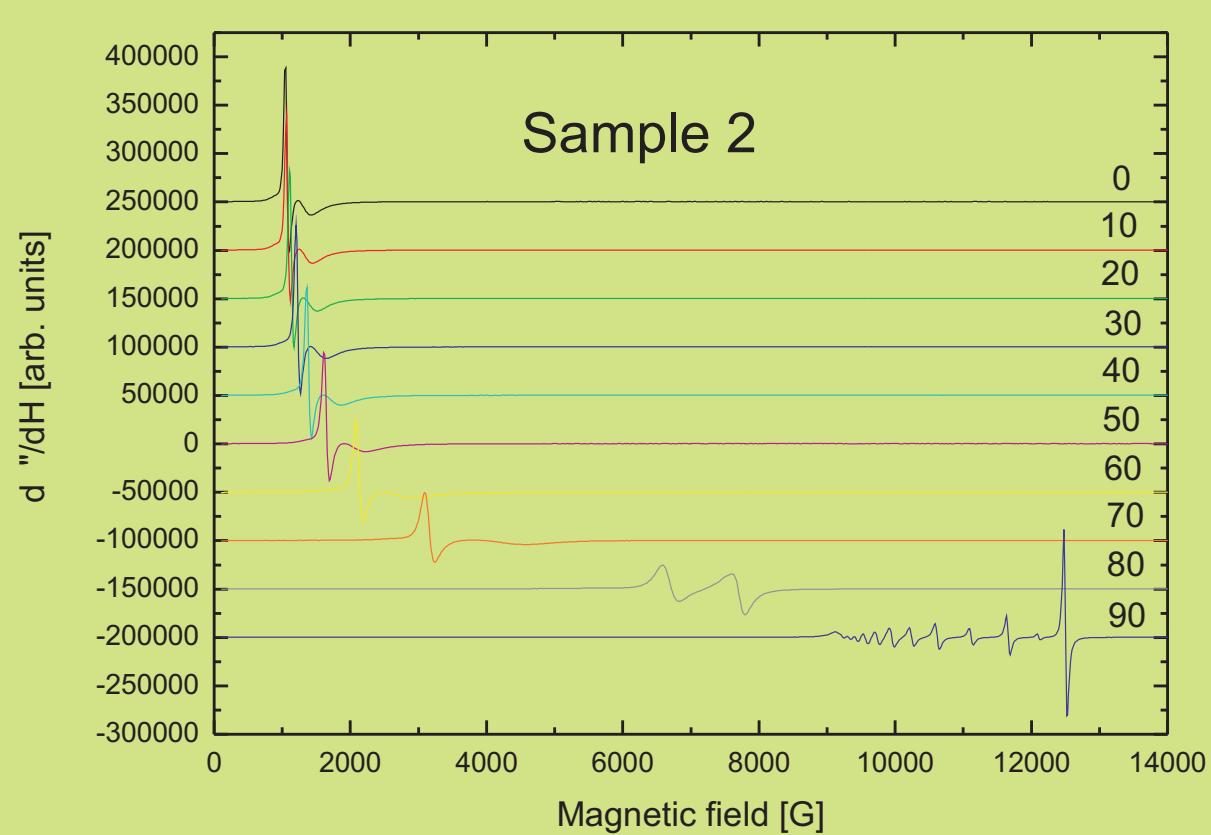
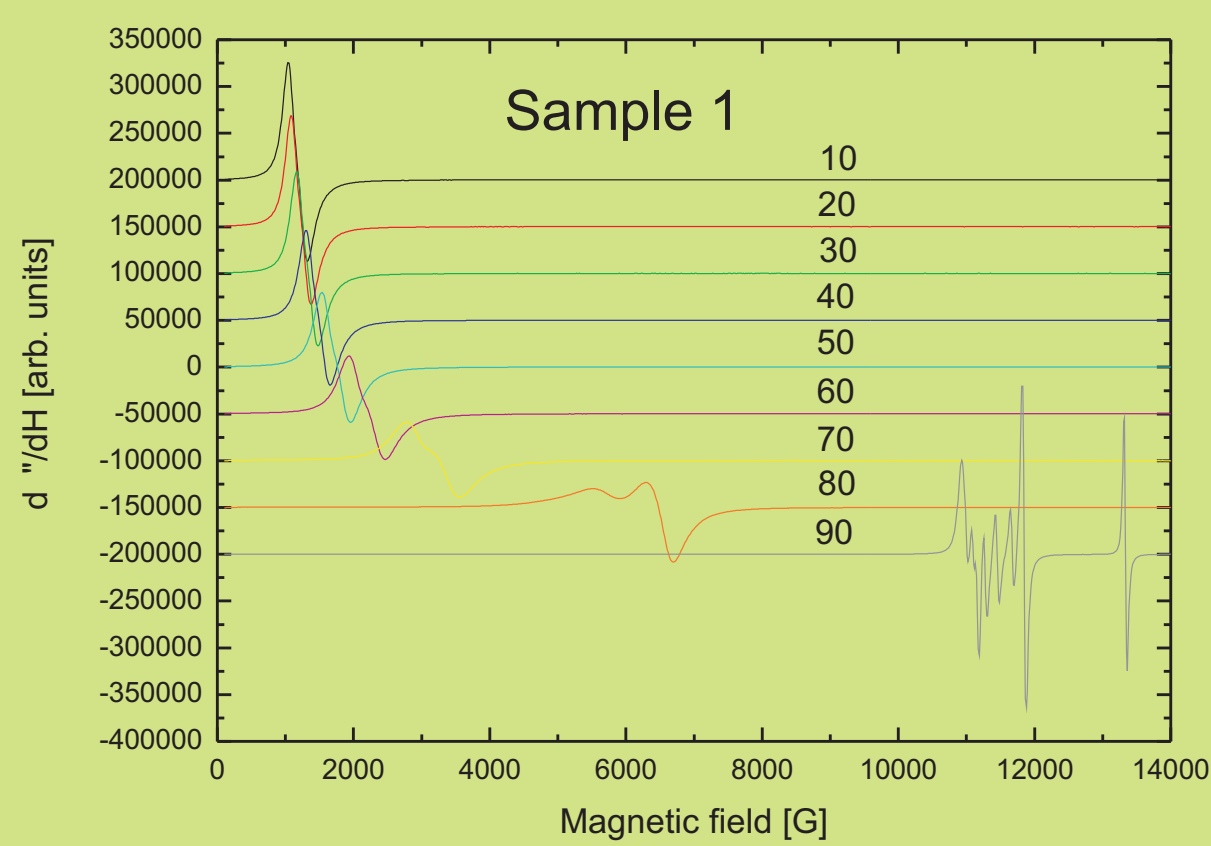


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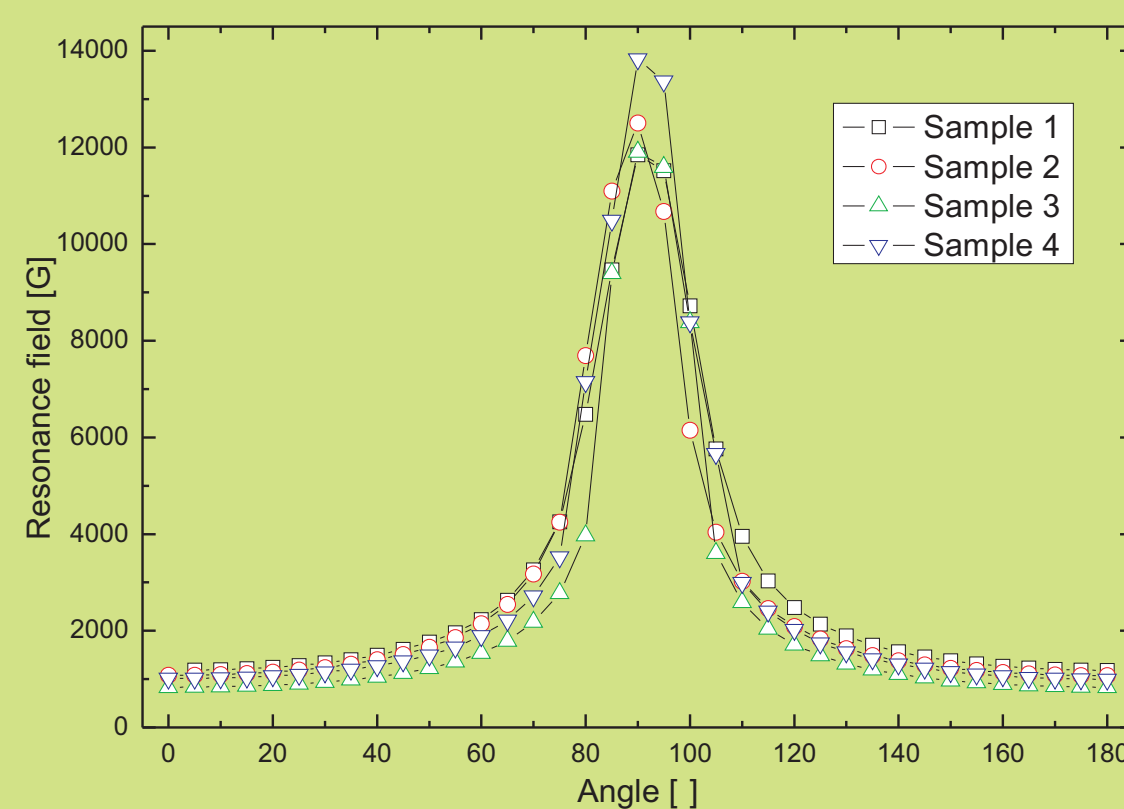
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For the external field perpendicular to the layer plane, the resonance field H_n is given by

$$H_n = 4 M_{eff} - D_{eff} \frac{k_n^2}{\hbar}$$

where:
 M_{eff} is the effective magnetization
 ω is the microwave frequency
 γ is the gyromagnetic ratio
 D_{eff} is the effective magnon stiffness constant
 k_n is the wave number of the n-th spin wave mode, $k_n = \frac{n\pi}{L}$



Conclusions

When the external field is parallel to the layer surface, only one resonance mode is observed in all samples, which is the uniform mode.
 When the external field is perpendicular to the layer surface, the FMR spectra consist of at least two modes.
 Both odd and even modes are excited with almost equal efficiency what can be explained by inhomogeneous structure of our layers
 As the separation of spin waves is proportional to n^2 , the spins of the surface layer should be pinned.
 The differences in H_n for different samples might be caused by different saturation magnetization of these samples.

Samples preparation

Coatings were deposited by reactive sputter deposition at different temperatures and total gas pressures. The deposition chamber was a cylinder with 300 mm diameter and 400 mm high. The magnetron gun with the target was located on the bottom of the chamber. 50 mm diameter target was made of X10CrNi18-10 stainless steel. The target was powdered using a 750 W and 20 kHz pulsed dc supply at a mean target power of 200 W (~0.3 A). Silicon plates used as substrates were ultrasonically degreased, rinsed in alcohol and dried in hot air. Then substrates were placed on a heating holder and biased with RF source (power of 2 W). Coating were deposited for 90 min. Before the deposition, substrates were ion cleaned at pressure 2.66 Pa for 10 min. The parameters of the deposition are shown below

Sample designation	Temperature	Pressure
2	100 °C	0.4 Pa
1	200 °C	0.26 Pa
3	300 °C	0.26 Pa
4	300 °C	0.53 Pa

Experimental

Magnetic resonance spectra were registered on BRUKER E500 X-band (9.4 GHz). The ferromagnetic resonance (FMR) spectra were registered at room temperature using a goniometer enabling sample rotation around vertical axis.

