Thin films, consisting of contacting layers of iron group metals Fe, Co, Ni and rare earth metals oxides are perspective for use in spintronics. Due to exchange f–d interaction at them interface, magnetization and magnetoresistance of this d – metals are rising [1]. Since a magnetization of thin films greatly depends on them structure, it would be interesting to consider of structural influence from rare earth metals oxides to Fe, Co, Ni metal layers too. In this work the structural interaction is studied by example of two-layer Fe/Tb$_2$O$_3$ film, in which Fe and Tb were selected as having one of greatest magnetic moments in their groups (3.18 and 9.7 µB, accordingly), that is great energy of exchange f–d interaction.

Fe and Tb$_2$O$_3$ layers were deposited by electron-beam evaporation of Fe and Tb metals to monocrystalline NaCl substrate at follow conditions accordingly: $p = 5 \cdot 10^{-3}$ Pa, $v=25$ nm/min, $t = 280^\circ$C and $P_{O_2}=1\cdot10^{-2}$ Pa, $v=80$ nm/min, $t = 25^\circ$C. Firstly Fe layer was deposited and then Tb$_2$O$_3$. Thickness of Fe and Tb$_2$O$_3$ layers were 25 and 52 nm. After solution of NaCl substrate in distilled water and placing these films on a net with window about 25µ, the structure was investigated by electron diffraction method.

Fe layer deposited to substrate at 280°C had polycrystalline structure corresponded to cubic modification $\beta$-Fe with lattice period $a = 2,904$ Å, less than well known value $a = 2,91$ Å for volume samples.

Tb$_2$O$_3$ layer, deposited at 25°C had amorphous structure. After it’s deposition on the Fe layer, stretching of cubic iron lattice to $a = 2,917$ Å was observed. The stretching was accompanied by beginnings of strain about $\sigma = 2,206$ GN/m$^2$ and diminution of coherent dispersion blocks from 142Å (for Fe contacting with Tb$_2$O$_3$). That stretching of Fe crystalline lattice is bound up with influence of shot range ordering of amorphous Tb$_2$O$_3$, where parameters of all structure modifications considerably exceed that at Fe. For example, at cubic Tb$_2$O$_3$ structure $a=10,729$Å; hexagonal $a = 3,84$Å, $c = 6,13$Å; monoclinic $a = 14,03$Å, $b = 3,536$Å, $c = 8,717$Å [PDF files: 19-1328, 74-2131, 86-2478].

Thus, the deposition of Tb$_2$O$_3$ to Fe layer is accompanied by both beginning of exchange f – d interaction and stretching of Fe crystalline lattice, appearance of strain, diminution of coherent dispersion blocks.

References