CRYSTALLIZATION OF CoFeB ELECTRODES IN MAGNETIC TUNNEL JUNCTIONS

J. Kanak[1], P. Wiśniowski[1,2], A. Zaleski[1], W. Powroźnik[1], M. Czapkiewicz, S. Cardoso[2], P.P. Freitas[2], and T. Stobiecki[1]

[1] *Department of Electronics, AGH University of Science and Technology, Al. Mickiewicza 30, 30-059 Kraków, Poland*

[2] *INESC Microsystems and Nanotechnologies, Rua Alves Redol, 9-1, 1000-029 Lisbon, Portugal*

To establish relationship between crystallization of CoFeB electrodes and tunnel magnetoresistance (TMR), X-ray diffraction analysis (XRD) of pseudo spin valve (P-SV): Ta/Ru/Ta/CoFeB/MgO/CoFeB and exchange bias spin valve (EB-SV): Ta/Ru/Ta/PtMn/CoFe/Ru/CoFeB/MgO/CoFeB was performed.

It was found that the hexagonal Ru buffer layer is strongly textured in [002] direction with diffused Ta/Ru/Ta interfaces. The as-deposited paramagnetic PtMn layer was highly fcc (111)-oriented and transformed after annealing to antiferromagnetic fct (111)-oriented phase in EB-SV sample.

The CoFeB ferromagnetic electrodes were amorphous in as-deposited state and crystallized to bcc CoFe phase after annealing. The crystallization of annealed CoFeB electrodes in P-SV sample revealed stronger (002)-oriented texture than in EB-SV. We believe that due to this reason TMR ratio is significantly higher for P-SV junction (240 %) than for EB-SV (180 %).

Moreover, for P-SV and EB-SV junctions the bottom CoFeB electrode exhibited weaker (002)-oriented texture than the top electrode grown on highly (002)-oriented MgO. Importantly, the bottom electrode of EB-SV samples crystallize not only in [002] but also in [110] direction. Crystallization of CoFeB electrodes gave rise to increase of magnetization and magnetocrystalline anisotropy, and weak decrease in antiferromagnetic coupling of CoFe/Ru/CoFeB synthetic antiferrimagnet.

Acknowledgments: This work was supported by the EU MRTN-CT-2006-035327 SPINSWITCH.