Influence of magnetostriction on cross-section magnetic properties in bilayered ribbons

A. Titov - Department of Physics and Nanotechnology Centre
VŠB - Technical University of Ostrava
andrii.titov.st@vsb.cz

Samples
- 36 µm thick and 8 mm wide
- Co₆₆Fe₃₄Cr₂Si₃B₁₂/Co₆₆Fe₃₄Cr₂Si₃B₁₂ - denoted Co/Co
- Co₆₆Fe₃₄Si₆₁B₁₂/Fe₆₁Si₆₁B₁₂ - denoted Co/Fe
- samples were prepared by Planar Flow Casting (PFC)
- PFC uses one crucible divided into two chambers

Microstructure:
- X-ray diffraction
- Nanoindentation
- Scanning electron microscopy
- Differential intensity magneto-optical method - hysteresis loops
- MOKM (magneto-optical Kerr microskopy) - domain structure

Measurement techniques
- Surface magnetic properties:
  - Co/Co sample - surface
  - Co/Fe sample - cross-section

Microstructure:
- Narrow interface, almost invisible in the SEM due to the similar element composition in the layers.
- Sharp transition of element content across the interface and sharp changes in the both hardness and Young's modulus.
- Much broader and visible interface.
- Slower transition of elements across the interlayer featured by mixing of Co and Fe.
- Almost continuously changes of both mechanical characteristics.
- Strong influence of the interlayer on the bulk magnetic properties.

CONCLUSIONS
The obtained results yield an importance of the chemical composition and accompanying dissimilar magnetostriction coefficients of the layers. The results obtained at the Co₆₆Fe₃₄Si₃B₁₂-based sample, the layers of which differ only slightly in the Co/Fe ratio, yield thin interlayer and the magnetic domains are extended only inside the layers but they originate close to the interface. Contrarily, the physical properties of the Co₆₆Fe₃₄Si₃B₁₂ sample change from one side to the other across the thicker interlayer and, moreover, the markedly different magnetostriction coefficients evoke coiling the sample and inducing additional stresses influencing the fully different magnetic domain patterns.

Acknowledgments
The work has been supported by the projects SP 2014/27 and the Nanotechnology-basis for international cooperation project (Reg. No. CZ.1.07/2.3.00/30.0074).