# Stability diagram of magnetization switching in perpendicular magnetic tunnel junctions

W. Skowroński,[1] M. Czapkiewicz,[1] S. Ziętek,[1] J. Chęciński,[1]
M. Frankowski,[1] P. Rzeszut,[1] J. Wrona,[2] and T. Stobiecki[1]

[1] *AGH University of Science and Technology,*
*Department of Electronics, Al. Mickiewicza 30, 30-059 Kraków, Poland*
[2] *Singulus Technologies, Kahl am Main, 63796, Germany*

Perpendicular magnetic tunnel junctions (MTJs) with a composite free layer (FL) of different thicknesses are investigated to balance tunneling magnetoresistance (TMR) ratio and perpendicular magnetic anisotropy energy. After annealing at 400 °C, the TMR ratio reached 180 % at room temperature and 280 % at 20 K. The voltage vs. magnetic field stability diagrams measured in pillar-shaped MTJs with 130 nm diameter indicate the competition between spin transfer torque (STT), voltage controlled magnetic anisotropy (VCMA) and temperature effects in the switching process. An extended stability phase diagram model enabled the determination of both STT and VCMA coefficients responsible for the FL magnetization switching [1].

**References:**

[1] W. Skowroński et al. arxiv.org/abs/1701.06411 (2017)

*Project supported by Polish National Center for Research and Development No. LIDER/467/L-6/14/NCBR/2015. TS acknowledges Statutory Grant 11.11.230.017.*