Substrate influence in the barrier quality of multiferroic tunnel junctions, model and experiments.

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In this work a phenomenological approach [1] is proposed to analyze the electrical transport through an insulating barrier in ferromagnetic (FM)/ferroelectric (FE) bilayers, using conductive atomic force microscopy (CAFM). We have found that $I(V) = A_0 \cdot V^B$, where A_0 and B depend linearly with the barrier thickness. The proposed model allows to obtain critical information for the development of magnetic tunnel junctions. Moreover, assuming a Gaussian distribution of the barrier thickness, it is possible to fit the measured current distribution and to study the thickness homogeneity of the barrier. The influence of the substrate in the electrical properties of the FE/FM bilayers was studied in the frame of this model. MgO substrates with higher roughness than SrTiO3 ones, were found to increase the barrier thickness distribution and to increase the attenuation length in the material, reducing the barrier quality for the developing of multiferroic tunnel junctions.

[1] M. Sirena, Journal of Applied Physics, 110, 063923 (2011).