

## Fabrication of ferroelectric tunnel nano-junctions in P(VDF-TrFE)-thin layers with conductive-AFM control

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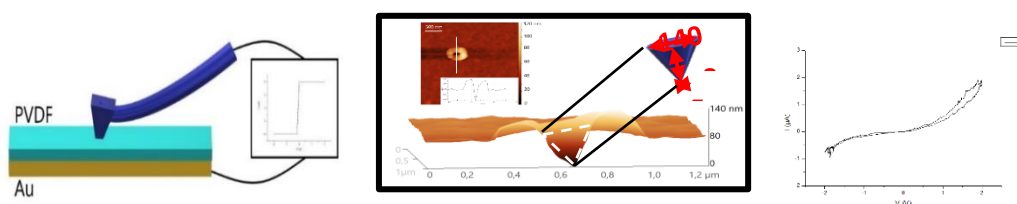
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### Abstract:

Start In the frame of the FEOrgSpin project (Ferroelectric control of organic/ferromagnetic spinterface) funded by the National French Research Agency (ANR), one of the objectives is to control the hybrid ferroelectric organic/ferromagnetic metal interface, as known as “spinterface”, for the development of future advanced data storage devices based on spin electronics. For example, the spin polarization of spinterface at the Fermi level can be different or even of opposite sign to that of the adjacent ferromagnetic electrode, annihilating the spin properties of the device.

Recently, we demonstrated the possibility of modulating the spin polarization at the poly(vinylidene fluoride) (PVDF)/Co interface by changing the direction of the ferroelectric polarization within the PVDF material [1]. We obtained important results regarding the surface morphology, the conduction properties as well as piezo-/ferroelectric behavior of these organic ferroelectric barrier layers by using different techniques/tools of Atomic Force Microscopy (AFM), such as piezoelectric force microscopy, for nanoscale investigation. Now, in order to optimize the parameters of spin transfer, it becomes necessary to develop nanometric-size organic tunnel junctions to improve the effects of both electroresistance (TER) [2] and magnetoresistance (TMR). The solution chosen consists in the development of tunnel nano-junctions indentation by the use of conductive-AFM probes (CT-AFM) [3]. Here the feedback control of the process is operated by the current measurement during indentation and allows for a sub-nanometer control of the thickness of the junction (Fig. 1)



**Figure 1.** (left) Schematic representation of the nano-indentation step using the CT-AFM technique. (center) AFM image showing the indented area. (right) Local I-V curve showing the evolution of the electrical properties of the nano-junction during indentation.

[1] S. H. Liang et al., Adv. Mater. 28, (2016)

[2] B.B. Tian et al., Nat. Commun. 7, (2016)

[3] K. Bouzehouane et al., Nano Lett. 3, (2003)