

Looking at the interface : Advanced PhotoEmission techniques for functional oxides

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Invité par François BERTRAN

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Salle A1.0.59

Séminaires

Ferroelectric devices could be an alternative to magnetic based memories for future high-density data storage. Such devices have considerable advantages: they are non-volatile, have fast read-write times, low energy consumption and use realistic voltages. However, before considering future applications based on such materials, a better understanding of the electronic properties of nanometer-thick ferroelectric (FE) films is fundamental.

The defining property of a FE material is a spontaneous macroscopic polarization which can be reversed under an applied electric field. Switching the polarization of such films requires a metallic contact, raising fundamental issues on the behavior of the interface between the FE layer and the electrode. More questions arise when the electrode itself is an oxide showing exciting properties, e.g. magnetism or a metal-insulator transition.

The desire to explore valence electronic structure at its most fundamental dispersing-band level and the need to selectively determine these properties at the buried interface foster the development of innovative characterization methods based on photoemission spectroscopy. However, these techniques are still not commonly used.

In the talk, I'll show how these novel methods can be used to investigate the wide range of properties that arise at oxide interfaces by presenting recent results on two different oxide bi-layers.

As a first example, we combine time-resolved photoelectron detection and a specially designed sample holder allowing *in-situ* application of bias to fully characterize the dynamic electronic response of the interface between a ferroelectric BaTiO₃ thin film and a Platinum electrode. These results give new insight on the dynamics of the screening of polarization and its consequences on macroscopic properties such as electric conduction [1].

On a second part, we use hard x-ray interference effects to add depth-resolution to the already extensive information provided by photoelectrons. By comparing the experimental results to theoretical simulations, we are able to extract the depth-resolved electronic properties of the interface between a BiFeO₃ ferroelectric thin film and the Mott-insulator (Ca, Ce)MnO₃ [2]. We observe the formation of an interface-layer which accounts for the macroscopic behavior previously observed on such systems [3].

[1] J. E. Rault, G. Agnus, T. Maroutian, V. Pillard, P. Lecoeur, M. G. Silly, A. Bendounan, F. Sirotty, G. Niu, B. Vilquin, N. Barrett, *Phys. Rev. B* **87**, 155146 and **88**, 155107 (2013)

[2] J. E. Rault, S. Nemsak, G. K. Pálsson, G. Conti, A. Perona, A. Rattanachata, C. Conlon, S. Fusil, V. Garcia, M. Bibes, A. Barthélémy, J.-P. Rueff, and C. S. Fadley, *Use of Near-Total Reflection Hard X-Ray Photoemission, Including Interference Effects, to Study Buried Interfaces: Mn-doped BiFeO₃ on Ce-doped CaMnO₃* (in preparation)

[3] H. Yamada, M. Marinova, P. Altuntas, A. Crassous, L. Bégon-Lours, S. Fusil, E. Jacquet, V. Garcia, K. Bouzehouane, A. Gloter, J. E. Villegas, A. Barthélémy and M. Bibes, *Sci. Rep.* **3**, 2834 (2013)



Ce séminaire sera suivi d'une pause-Café



Formalités d'entrée : accès libre dans l'amphi du Pavillon d'Accueil. Si la manifestation a lieu dans le Grand Amphi SOLEIL du Bâtiment Central, merci de vous munir d'une pièce d'identité (à échanger à l'accueil contre un badge d'accès).

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