Highlights

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Defective Interfaces in Yttrium-Doped Barium Zirconate Films and Consequences on Proton Conduction

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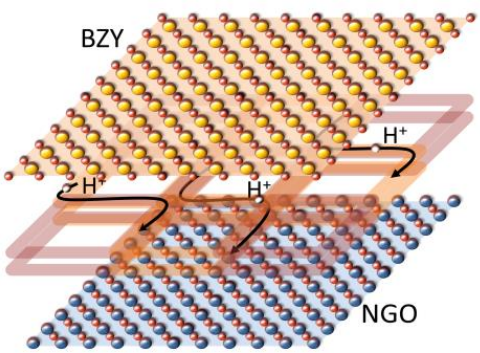
Yttrium-doped barium zirconate (BZY) is one of the most promising electrolyte materials for protonic solid oxide micro fuel cells based on thin films. In this field, it was largely reported, both theoretically and experimentally, that disorder and reduced dimensionality offer new routes to enable high performance electrochemical energy conversion devices. Therefore, a direct characterization of interfaces between the electrolyte film and the substrate is important, but also a very challenging task.

In this framework, here we use state-of-art electrochemical strain microscopy in a novel cross-sectional measuring setup to directly visualize the interface reactivity of BZY films with nanoscale resolution. The local electrochemical investigation is compared with the structural information obtained by state of art scanning transmission electron microscopy, the unique technique able to give information on the local distortions at the interface between film and substrate.

The results of this study show a clear correlation between the conductivity of BZY films and the misfit dislocation network, which introduces a novel 2D transport phenomenon at the interface. The relevance of these results consists in opening a new avenue to understand low-dimensional properties at the nanoscale which are critical for several current and future technologies, especially in the field of energy storage and production. This work, in perspective, will shine a light in exploitation of the extraordinary properties of these strongly defective interfaces.



Schematic drawing of the interface between BZY film and NGO substrate with the dislocation network as fast pathway for proton conduction.

V. Foglietti et al. Appl. Phys. Lett. 2014, 104, 081612.