PI-MOCVD original buffer layers for $YBa_2Cu_3O_{7-\delta}$ coated conductors

S. Beauquis[1], S. Donet[1], F. Weiss[1], H. Roussel[1], and A. Abrutis[2]
[1]: Laboratoire des Matériaux et du Génie Physique – ENSPG - INPG, CNRS-UMR5628, BP46, F-38402 Saint Martin d'Hères, France
[2]: Vilnius University, department of General and Inorganic Chemistry, Naugarduko 24, 2006 Vilnius, Lithuania

Coated conductor applications in power technologies require stabilization of the high-temperature superconducting layer against thermal runaway. Conductive oxide buffer layers can provide and electrical contact between the high-temperature superconducting film and the metal substrate improving electrical stability in the event of a transient to a dissipative regime. Conductive multilayers of $YBa_2Cu_3O_{7-\delta}$ /$LaNiO_3$ and $YBa_2Cu_3O_{7-\delta}$ /$Sr_{1-x}Nb_xTiO_3$ were epitaxially grown by Pulsed Injection Metal Organic Chemical Vapor Deposition (PI-MOCVD) on different substrates: single crystal $LaAlO_3$ and $SrTiO_3$, biaxially textured as well as on Ni RABiTS micro alloyed substrates.

The principle of the pulsed injection MOCVD method is computer controlled injection of precise micro doses of organic solution containing a mixture of metal-organic precursors into a low-pressure hot-wall reactor. They are flash evaporated and transported by carrier gases to a heated substrate where precursors decompose and oxides films form.

The microstructure of the films was studied by X-Ray diffraction (XRD) in a D5000 Siemens diffractometer. The critical temperature of YBCO films have been determined from AC susceptibility measurements.
X-ray diffraction (XRD) results (θ-2θ scans and φ scans) show that they have only a strong c-axis texture (Fig 1 and Fig 2). Films are superconducting with critical temperature of about 85-90K.

Textured insulating HfO_2 buffer layers have also been deposited directly on Ni (W) RABiTS substrate. No NiO peaks were found in θ/2θ scans of HfO_2 films, this means that insulating NiO interlayer did not form during the deposition of HfO_2 layers on Ni(W) substrates. ϕ scans made for the (111) HfO_2 reflection demonstrated a preferential in-plane orientation of HfO_2 crystallites (Fig. 3). Films of YBCO will be deposited ex-situ on these Ni(W/Mo)/HfO_2 layers.

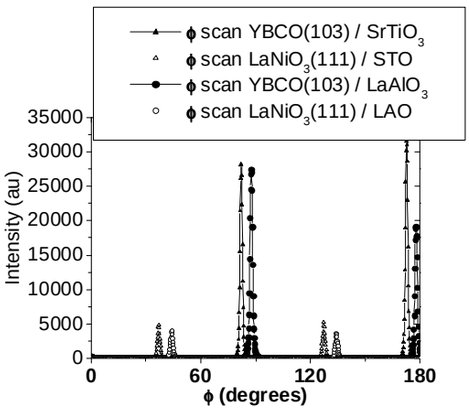

Figure 1: ϕ scan of $LaNiO_3$ (111) and YBCO (103) deposited on STO and LAO

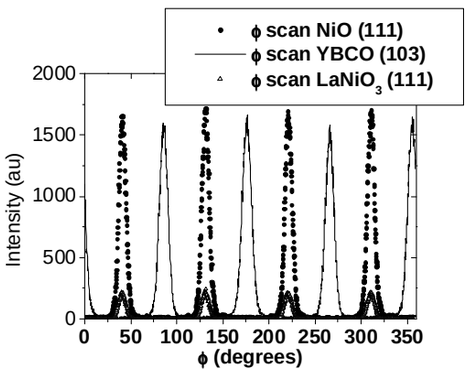

Figure 2: ϕ scan of $LaNiO_3$ (111) and YBCO deposited on Ni(Mo)/NiO

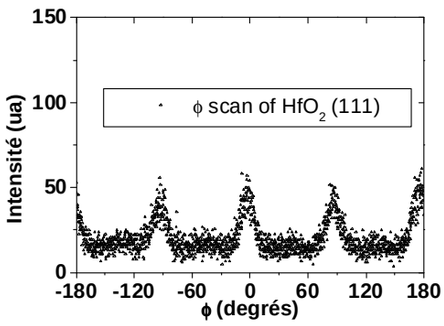

Figure 3: X-ray Diffraction ϕ scan of HfO2 (111)