Texture Influence on Critical Current Density of YBCO Films deposited on (100)-MgO substrates

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The texture of two series of YBCO films deposited on (100) MgO substrates by Pulsed Laser Deposition or Metal Organic Chemical Vapour Deposition was analysed using the pole figure technique. The film thicknesses are in the range 1500Å-2800Å.

All the films exibit c-axis orientation perpendicular to the surface ($c_\perp$), as revealed by classical θ-2θ X-ray diffraction. The {103} pole figures obtained by the Schulz reflection method show a preponderant epitaxial growth orientation i.e. the a and b-crystal axes of the film are aligned with the substrate axes ($c_{\perp 0}$). In addition some minor in-plane orientations were found in particular with a_{YBCO} rotated by 45° around c_{YBCO} from the $c_{\perp 0}$ orientation ($c_{\perp 45}$). The ratio $c_{\perp 45}/c_{\perp 0}$ orientations was measured by integrating the poles in the specific angular range. This ratio does not exceed 12% in the worst film. On the other hand, {102/012} pole figures reveal in some samples the presence of YBCO crystallites with a or/and b axes perpendicular to the film surface ($a_\perp$). The ratio $a_\perp/c_\perp$ orientations was evaluated. The high intensity level of the poles allow to appreciate percentages as low as few tenth. The $c_{\perp 45}$ and $a_\perp$ orientations are both shown to drastically reduce the critical current density Jc, by one order of magnitude for approx. 1% of one or the other type of misorientation. The Jc variation versus $c_{\perp 45}$ and $a_\perp$ misorientations is non linear for both variables. CuO inclusions are present in the MOCVD films and seem to influence Jc. These inclusions are found textured and this texture has been studied.