Buffer layers and YBCO growth on Ni RABiT tapes.

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High Temperature Superconducting YBCO-coated conductors development remains one of the most challenging challenge for future energy saving. High density (Jc=1MA/cm²) films were recently demonstrated on Biaxially Textured Substrates (RABiTS), which transfer it texture to the YBCO film. In order to obtain high quality YBCO film (in-plane orientation of the film less than 10°) on a flexible support, buffer layers between the metallic tape and the YBCO film, typically 400nm has been required to adapt the mechanical stress and to avoid chemical interaction or diffusion inter-layers. In this paper are presented results obtained by Pulsed Injection Metal Organic Chemical Vapour Deposition (PI-MOCVD) technique on various Ni RABiT tapes. In a first step, we focused in developing suitable architecture mainly on Ni/CeO2 biaxial textured substrates. MOCVD of thin YSZ (200nm) with subsequent CeO2 (150nm) layer has been necessary to obtain high critical current density. The precursors used for the buffer layers and YBCO deposition are organometallic ones: Zr(thd)4, Ce(thd)3, Y(thd)3, Ba(thd)2, and Cu(thd)2 dissolved in 1,2-dimethoxyethane.

First, Ni pre-buffered tapes were coated with YBCO in a reel-to-reel system at transport velocity of 3m/h. Small (10x10mm) and longer tapes (10x40mm) were covered with 700nm YBCO thin film. SEM picture shows dense film with some CuO on surface (see Fig.3). The current critical densities measured by AC susceptibility were from 0.3 to 0.5MA/cm² at 77K correlated with a strong epitaxial growth as reported on Fig 2.

Secondly, Theva Gmbh supplied Ni/CeO2 tapes with 100nm CeO2 deposited by Thermal Evaporation, stabilising the surface for MOCVD process. Indeed the pure microalloy Ni tape obtained by a Rolling Assisted Biaxial Textured Substrate (RABiTS) process remain sensible to MOCVD operational deposition conditions (800°C with oxygen atmosphere). A complete characterisation of the Ni/CeO2 tape gave us an overview of the defects of the tape. The texture of the Ni/CeO2 reveals a pure cubic (ccf) structure (pole figure by XRD) on NiO film inducing defects amplified by addition of YSZ, Y2O3 or CeO2 films. The approach has been to regrow on NiO a thin film of NiO by MOCVD, with a selective growth followed by quasi-homoepitaxial growth of NiO on NiO. Improvement of the NiO texture was measured in XRD experiments and showed in-plane texture improvement of 2°. A smoothing effect depicted on SEM and AFM pictures shows the effect of a 350nm thin film of NiO by MOCVD. The grooves visible before were quite weaken The adequate buffer layer stacking Ni/W/NiO/YSZ/Y2O3/YBCO previously discovered consist in depositing 200nm of YSZ, 150nm Y2O3 and 750nm YBCO to obtain critical current densities Jc= 0.1MA/cm² on NiMo tapes.

Fig. 1. EBSD data of the Ni/CeO2 tape 50µm thick. Inverse pole figure (001).

Fig. 2. XRD diagram of the in-plane texture of the films

Fig. 3. SEM picture of the YBCO morphology on Ni pre-buffered tape.

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