

# Nanostructural Characterization of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ Coated Conductors with $\text{BaZrO}_3$ Rods Deposited by Pulsed-Laser Deposition

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## Introduction

In order to develop superconductive coils and superconductive instruments using  $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$  (Y123) coated conductors, it is necessary to enhance the critical current density ( $J_c$ ) values of the coated conductors in magnetic fields. Recent research efforts for future applications have been tried to form high density defects or distribute nano-sized particles to play role of the vortex pinning center in the superconductive layer. In particular, Kobayashi et al. [1, 2] have successfully distributed  $\text{BaZrO}_3$  (BZO) rods in Y123 coated conductors. Their Y123 layers were fabricated by pulsed-laser deposition (PLD) using a yttrium stabilized zirconia (YSZ) mixed Y123 target. In this study, we characterize the nanostructures of the Y123 coated conductor with BZO particles using transmission electron microscopy (TEM) in detail [3].

## Experimental method

Y123 layer was deposited by PLD using YSZ mixed Y123 targets on Hastelloy tape with a textured buffer layer ( $\text{CeO}_2/\text{Gd}_2\text{Zr}_2\text{O}_7$ ). Both cross-sectional and plan-view transmission electron microscopy (TEM) specimens of the Y123 layer were prepared by focused ion beam (FIB). These specimens were further thinned by standard ion thinning to remove FIB damaged layer formed on the specimens during the FIB milling. Then the nanostructural characterizations of the specimens were performed by TEM.

## Results and discussion

Fig. 1 shows a low magnification cross-sectional electron micrograph of the Y123 layer on  $\text{CeO}_2$  and selected area diffraction patterns. The Y123 layer is predominantly composed of c-axis oriented grains, and nano-sized BZO rods are found from the  $\text{CeO}_2$

interface to the surface of the Y123 layers. The BZO nano-rods formed in the Y123 layers are revealed as moiré fringes because the orientation relationships between Y123 and BZO are (001)Y123//(001)BZO and (100)Y123//(100)BZO. The BZO nano-rods are almost aligned in the (001) of Y123. From the moiré fringe studies, the BZO rods are considered to be continuous rather than intermittent rods. In the plan-view specimen, BZO sheets on the (001) plan of the Y123 were found.

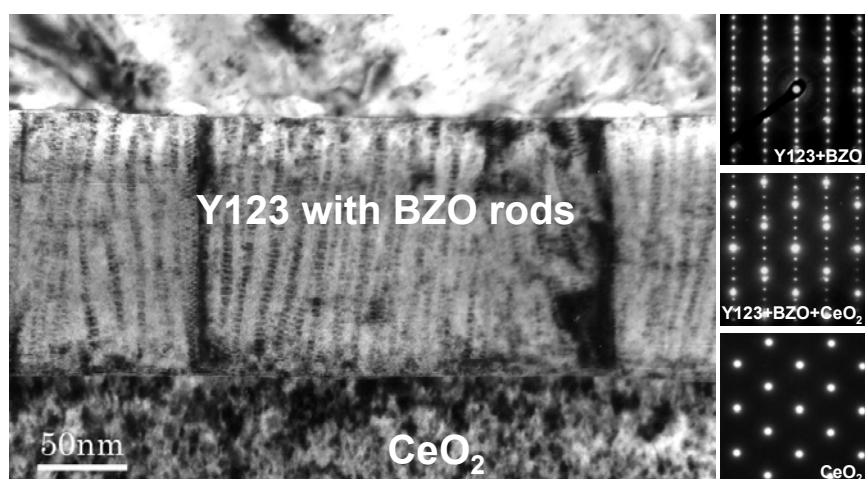


Fig. 1 Low magnification cross-sectional electron micrograph of Y123 layer formed by PLD using YSZ mixed Y123 target and selected area diffraction patterns from Y123 with BZO, the interface between Y123 and CeO<sub>2</sub>, and CeO<sub>2</sub>, respectively.

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## References

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