Intermediate Phase Study on YBCO Films Coated by Precursor Solutions With F/Ba Atomic Ratio of 2 - DTU Orbit (03/10/2019)

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In the chemical solution deposition process of YBCO superconducting films, fluorine is widely regarded to be of significant importance in avoiding the formation of BaCO3, which hinders the growth of high-quality YBCO films. On the other hand, great efforts have been made to decrease the fluorine content in the precursor solution due to the environmental contaminations of the fluorinated gaseous by-products. In this study, we demonstrate that an F/Ba atomic ratio of 2 in the precursor solution is sufficient according to the results of energy dispersive spectrometry and attenuated Fourier transform infrared studies. The intermediate phase evolution prior to the end of the sintering stage is also investigated by X-ray diffractometry and scanning electron microscopy. Liquid-like structures are observed, which are proposed to be responsible for the film densification in the early stage of YBCO formation. The formation of YBCO is accompanied by the consumption of oxygen-doped BaF2 (BOF), which is found to be highly textured. Moreover, in the early stage of YBCO formation, the crystallinity and texture of BOF enhance despite its consumption. After a full heat treatment, YBCO films with Jc of 5 MA/cm2 (77 K, 0 T) could be routinely obtained on lanthanum aluminate single-crystal substrates.

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