Improved High Temperature Superconductor Materials for Wind Turbine Generators

Effects of yttria addition on the structural and electrical properties of the YBCO thin films are studied. The films were deposited on (LaAlO3)3-(Sr2AlTaO8)7 substrates by pulsed laser ablation from targets with different elemental composition. The contents of elements in the film depend mainly on the yttrium content in the target. An increase of yttrium content leads to formation of a porous film with significant improvement of current-carrying capabilities (critical current density reaches 35 kA/cm2 at 77 K, 5 T, and exceeds 2 MA/cm2 at 50 K, 5 T). The Y-enriched YBCO film remains c-oriented up to 600 nm thickness with no suppression of the critical current density in the film. Yttria decoration of the substrate surface prior to deposition resulted in formation of YBCO films with low strain and high crystal perfection. In contrast to the Y-enriched YBCO films, the films on yttria layers are dense. At temperatures of 77 K and above the YBCO films on yttria-decorated substrates exhibit critical current densities comparable to or better than that of the Y-enriched films.

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