Recent HTS bulk progress of REBCO

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Abstract — The recent progress on the growth of REBCO bulk superconductors for practical applications and fundamental studies are reviewed, including: superheating property of REBCO thin film and its applications in seeding the growth of REBCO superconductors; air-processed LREBCO bulk superconductors (LRE=Nd, Sm, and Gd) with high performance; modified top-seeded melt-growth for large sized YBCO crystals with and without chemical doping.

The main content of this PPT is based on our recent review article in *Progress in Materials Science*, entitled "Peritectic melting of thin films, superheating and applications in growth of REBCO superconductors", YY Chen, XX Cui, and X Yao, Progr. Mat. Sci. 68 (2015) 97-159.

Superheating of solids, an unconventional phenomenon in nature, can be achieved by suppressing the heterogeneous nucleation of melt at defect sites, such as free surfaces and internal grain boundaries. In recent years, experimental evidences have clearly proved that the YBCO (Y123) thin film with a free surface possesses a superheating capacity, which is mainly attributed to the film/substrate structures, distinctively consisting with low-energy surface and semi-coherent interface. Like most functional oxides, YBCO (denoted as α-phase) is characterized by a peritectic melting: $\beta \rightarrow \alpha +$ *liquid* . Its superheating behavior certainly relates to this peritectic reaction. Furthermore, REBCO (RE123, RE: rare earth elements) thin films with high thermal stability have been successfully employed as seed materials in inducing the growth of REBCO materials, such as thick film, single crystal and single domain bulk. Therefore, this superheating property of thin films is of great importance in both scientific study and practical application. In this paper, the up-to-date researches covering on the superheating phenomenon of the α-phase film, its mechanism and applications in growth of REBCO superconductors are reviewed, which is supposed to be valid for more thin films of functional oxides that have the same nature as the YBCO film/substrate.

Keywords (Index Terms) — Peritectic melting, thin film, superheating phenomenon, REBCO superconductor, phase transition, seed materials, crystal growth.