

Department of Physics

Condensed Matter Physics

Clarendon Laboratory, Parks Road, Oxford OX1 3PU



CONDENSED MATTER SPECIAL SEMINAR

Tuesday 27 August at 14.15

“Greatly enhanced oxygen diffusion in high temperature superconducting materials (REBCO) under specific atmosphere”

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REBa₂Cu₃O_y (RE: Rare earth elements, $y = 6-7$; REBCO) has a high critical temperature ~ 90 K and exhibits high critical current properties in magnetic fields. REBCO melt-textured bulks, which are considered to be large pseudo single crystals, are suited for applications using their high trapped field properties. Higher trapped field properties are generally achieved by increasing both intergrain critical current density (J_c) and bulk diameters. Since melt-textured bulks have high density of nearly $\sim 100\%$, a processing time to control the oxygen composition throughout the bulks drastically increases when the diameter of the bulk increases. Typically, oxygen annealing requires more than a few hundreds of hours for large bulks under oxygen atmosphere. Our latest study revealed that diffusion velocity of oxygen is greatly enhanced when water vapor coexists in the oxygen annealing process. Oxygen-diffusion constants under dry and humid oxygen conditions were estimated using approximated diffusion equations where the oxygen-diffusion along c -axis is negligible. It was revealed that an oxygen-diffusion constant at 400°C of the YBCO melt-textured bulk annealed under humid oxygen atmosphere was $\sim 4.3 \times 10^{-11}$ m²/s, whose value was almost twice as large as that under conventional dry oxygen atmosphere of $\sim 2.2 \times 10^{-11}$ m²/s. These results strongly indicated that oxygen annealing under humid atmosphere is very promising for shortening of the processing time of REBCO melt-textured bulks.

Host: Shiv Singh

Audrey Wood Room, Clarendon Laboratory