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Fri-Mo-Po.02-03: Electromagnetic properties YBCO bulk superconductor with porous structure

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In the melt heat treatment process for growing YBaCuO superconducting single crystals, increasing the distribution density of flux-pinning particles, Y2BaCuO5, is critical. The flux-pinning effect occurs at the interface between Y2BaCuO5 and YBa2Cu3O7, so a Y1.6Ba2.3Cu3.3O7-y bulk was fabricated to enhance Y2BaCuO5 concentration and improve oxygen diffusion during growth. However, the high viscosity of the molten material often traps gases like O2 and CO2, forming pores that degrade electrical, magnetic, and mechanical properties. Reducing pore density is thus essential for high-density superconductors. To address this, artificial holes were introduced to increase surface area and allow gas escape during oxygen annealing, significantly reducing pore density. Experimental results showed that the artificial hole structure reduced porosity during melting and annealing, enhancing gas discharge. Using a Nd-B-Fe magnet (30 mm diameter, 5.27 kG surface tension) under zero-field cooling, the repulsive force of the bulk with artificial holes reached 116.228 N, compared to 72 N for the hole-free bulk. The remanent magnetic field of the hole bulk was 481.92 mT, much higher than the 228.78 mT of the bulk without holes. These findings demonstrate that artificial holes improve oxygen diffusion and reduce porosity, enhancing the superconducting properties. This research was supported by Korea Electric Power Corporation.(Grant number : R22XO05-01)

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