Effect of Y_2O_3 Nanoparticles on Flux-pinning Properties of $YBa_2Cu_3O_{7-x}$ Thin Films

Hai-Duc Tran[a], D. Sreekantha Reddy[a], Chang Hwan Wie[a], Byeongwon Kang[a,*], Sangjun Oh[b], Sung-Ik Lee[c]

[a] *Chungbuk National University, Cheongju, Korea*
[b] *National Fusion Research Institute, Daejeon, Korea*
[c] *Sogang University, Seoul, Korea*

Introduction of proper impurity into the $YBa_2Cu_3O_{7-x}$ (YBCO) thin films is an effective way to enhance its flux-pinning properties. We investigate the effect of the introduction of Y_2O_3 nanoparticles on the critical current density J_C of YBCO films. Y_2O_3 nanoparticles are created perpendicular to the film surface (parallel with the c-axis) either between YBCO and substrate or on top of YBCO, YBCO/Y_2O_3/LAO or Y_2O_3/YBCO/STO, by pulsed laser deposition. The deposition temperature of YBCO films were varied (780^{o}C and 800^{o}C) to modify surface morphology of YBCO films. Surface morphology characterization reveals that the lower deposition temperature of 780^{o}C creates nano-sized holes on the YBCO film surface which may behave as intrinsic pinning centers, while the higher deposition temperature produces much denser and smoother surface. J_C values of the YBCO films with Y_2O_3 particles are either remained nearly the same or decreased for the samples in which YBCO is grown at 780^{o}C. On the other hand, J_C values are enhanced for the samples in which YBCO is grown at higher temperature of 800^{o}C. The difference in the effect of Y_2O_3 can be explained by the fact that the higher deposition temperature of 800^{o}C reduces intrinsic pinning centers and J_C is enhanced by introduction of artificial pinning centers in the form of Y_2O_3 nanoparticles.

Keywords: YBCO thin film, Critical current density, Pinning centers, Y_2O_3