Improved current transport properties of post annealed Y1Ba2Cu3O7-x thin films using Ag doping

The influence of Ag doping on the transport properties of Y1Ba2Cu3O7–x thin films prepared by Y, BaF2, and Cu co-evaporation and optimized ex situ post annealing has been investigated. Both undoped and Ag doped films have values of $T_c$ above 90 K, but $J_c$ (77 K) is highly dependent on the nominal thickness ($t_{nom}$) of the as-deposited film. For undoped films with $t_{nom} > 106 \text{A/cm}^2$ decreases monotonically with increasing film thickness. Above 300 nm $J_c$ (77 K) decreases rapidly to values below $5 \times 10^5 \text{A/cm}^2$. Ag doped films with $t_{nom} \geq 200 \text{ nm}$ have higher $J_c$ (77 K) values than those of undoped films. Ag doped films have a maximum in $J_c$ (77 K) around 250 nm. For the undoped films, there is a large decrease in $J_c$ (77 K) for Ag doped films with $t_{nom} \geq 300 \text{ nm}$. It was found that the higher values of $J_c$ (77 K) for the Ag doped films were due to a better epitaxial growth of the YBCO compound. The low values of $J_c$ (77 K) for both undoped and Ag doped single layer films with $t_{nom} \geq 300 \text{ nm}$ were found to be due to the absence of 1–2–4 inclusions in these films. Based on these findings high $J_c$ (77 K) films with $t_{nom} > 300 \text{ nm}$ were grown by successive deposition and annealing of films with $t_{nom}$.
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