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Properties of electron-doped high temperature superconductor $Nd_{2-x}Ce_xCuO_4$ Films deposited by TFA-MOD

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Superconducting materials with a high in-field critical current density (J_c) and a low-cost process are required for superconducting applications such as nuclear magnetic resonance equipment, generators, and energy storage devices. The in-field J_c is strongly related to not only the vortex pinning but also crystallinity and critical temperature (T_c). The trifluoroacetates metal organic deposition (TFA-MOD) process is effective process to crystalize the high crystallinity film and introduce the artificial pinning centers. We reported that the TFA-MOD derived hole-doped high temperature superconductor (HTS) $(Y_{0.77}Gd_{0.23})Ba_2Cu_3O_y$ ((Y,Gd)BCO) film shows high in-field J_c due to high crystallinity and T_c even with the introduction of high density of adding artificial pinning centers [1]. Although electron-doped $RE_{2-x}Ce_xCuO_4$ (RECCO, RE = Nd, Pr, Eu…) is also high temperature superconductor, J_c in RECCO film has not yet been clarified.

In this work, we report that the structural and electrical properties of TFA-MOD derived $Nd_{2-x}Ce_xCuO_4$ (NCCO, x = 0, 0.15) films grown on the substrates with various lattice mismatch. The X-ray diffraction result shows that c-axis oriented NCCO films were grown on $LaAlO_3$ and $DyScO_3$ substrate. The c-axis oriented NCCO films show high crystallinity ($\Delta\omega \approx 0.14°$). The ρ-T curve of the NCCO (x = 0.15) film on $LaAlO_3$ shows superconducting transition ($T_c \approx 9$ K). This T_c value is lower than that of the bulk value (~24 K). The low T_c could be attributed to the lattice mismatch between the NCCO and the $LaAlO_3$ substrate (-4.0%, compressive strain). The structural and electrical properties of NCCO films grown on substrates with various lattice mismatch will be reported.

[1] M. Miura et al., NPG Asia Materials 9, (2017) e447

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