Annealing dependence of ferroelectric domain patterns in h-REMnO$_3$

JAE SUNG SHIN, Seoul Natl Univ, NARA LEE, YOUNG JAI CHOI, Yonsei University, SEUNG CHUL CHAE, Seoul Natl Univ — Topological vortices with complex ferroelectric domains and domain walls exist in hexagonal rare-earth manganites(h-REMnO$_3$). When h-REMnO$_3$ crystals are grown below the ferroelectric-trimerization transition temperature ($T_c$), they exhibit stripe domains. However, when a h-REMnO$_3$ crystal with stripe domains is heated above and cooled down across $T_c$, vortex domains emerge in the crystal. The networks of vortices are found to be in two different types: type-I domains with roughly equal fractions of upward and downward polarization domains and type-II domains with one dominant polarization. In this presentation, we report the post annealing effect on the ferroelectric topology under varying the ambient condition with N$_2$ gas. We observed two different types (type-I and type-II) of vortex domains using piezoresponse force microscopy and compared the topology change with Monte Carlo simulation with varying internal electric field. We observed domains of YMnO$_3$ start to increase upward polarization domain area fraction from 10% to 65% through the post annealing processes. We analyzed the correlation between internal electric field and off-stoichiometry condition.