Supporting Information

Dipole-correlated carrier transportation and orbital reconfiguration in strain-distorted $SrNb_xTi_{1-x}O_3$

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Additional XRD and RSM results

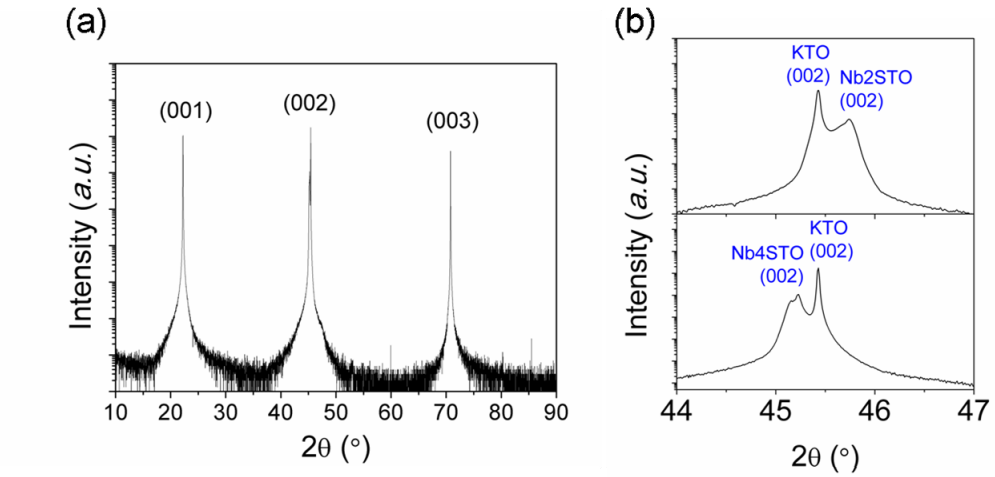


Figure S1. (a) XRD patterns (θ-2θ scan) for $SrNb_{0.4}Ti_{0.8}O_3/KTaO_3$ (001) and **(b)** XRD patterns $SrNb_{0.2}Ti_{0.8}O_3/KTaO_3$ (001) and $SrNb_{0.4}Ti_{0.6}O_3/KTaO_3$ (001). The film and substrate show the same crystal structure and orientation, since the diffraction peaks for the film are present beside those for the substrate. It indicates that as-grown thin films exhibit the same crystal structure and orientation as compared to the substrate.

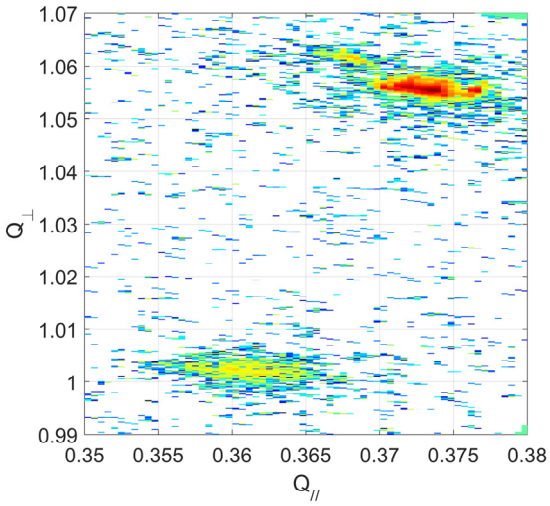
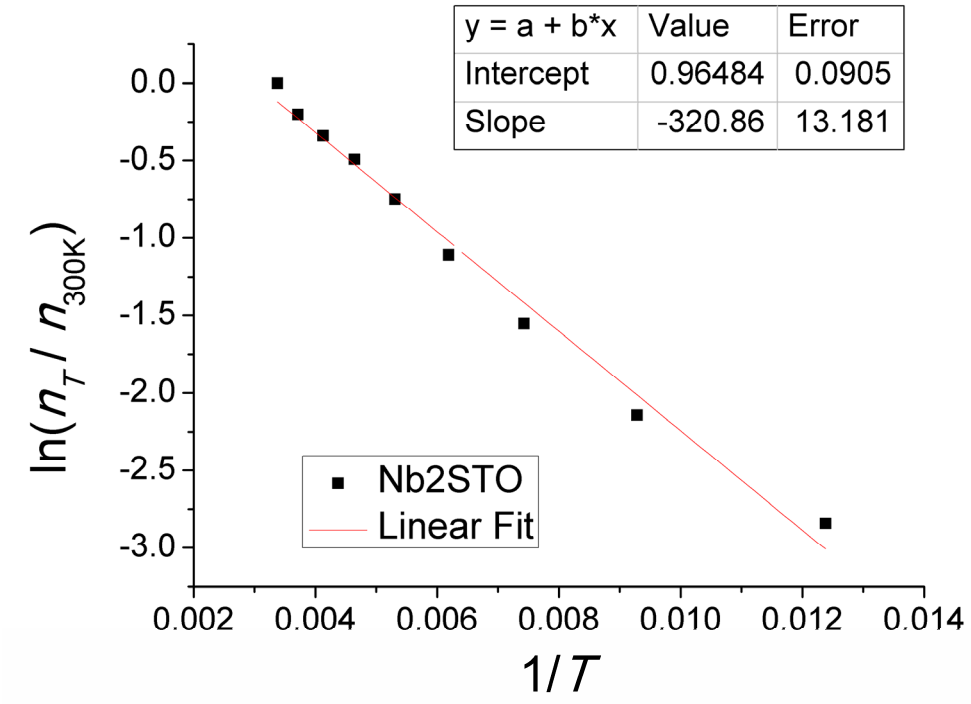


Figure S2. RSM results for *as-grown* $SrNb_{0.2}Ti_{0.8}O_3/LaAlO_3$ (001) with a thickness around 50 nm. The upper and lower diffraction patterns are the reciprocal space vectors of [114] from the substrate and film, respectively. Smaller $Q_{//}$ and $Q_{\perp}$ for the film compared with the substrate were observed. The interfacial strain is completely relaxed at an early stage of the deposition from a large lattice mismatch (3.65%).



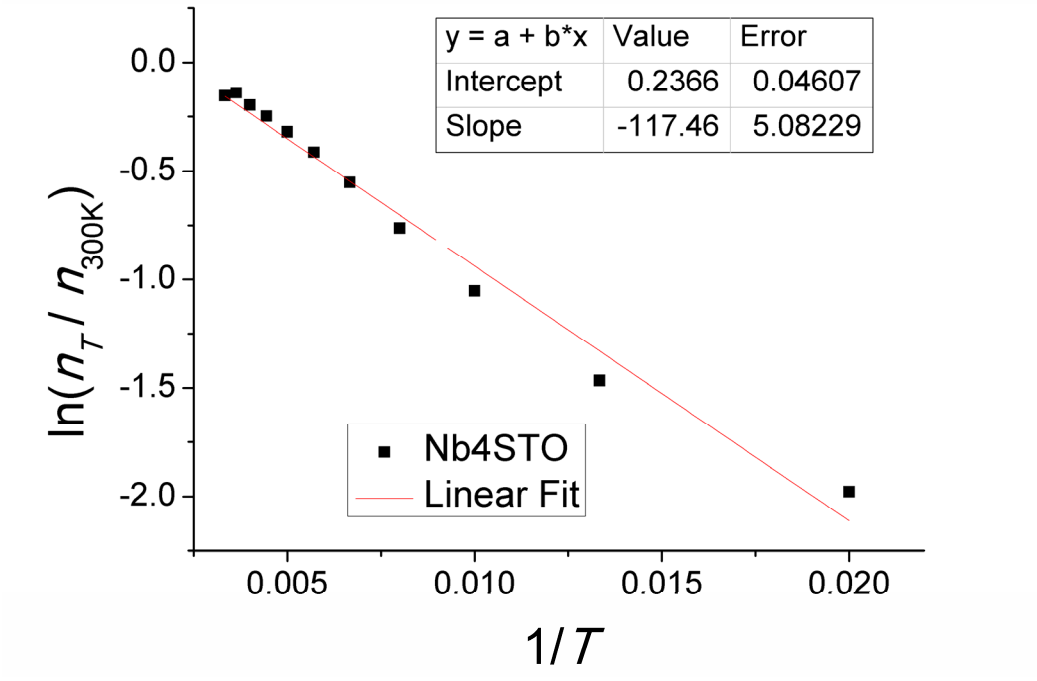


Figure S3. Estimation of the activation energy was estimated from the temperature dependence of carrier concentration as shown in Figure 2b. The temperature dependence of the carrier concentration by, $n = N_{Sat.} Exp(\frac{-\Delta E}{k_B T})$, from 50-300 K. Transforming the above

formula to $\ln(n / n_{300K}) = \ln(N_{Sat.} / n_{300K}) + (\frac{-\Delta E}{k_B})(1/T)$ and plotting $\ln(n / n_{300K})$ vs. $1 / T$, obtains the above two graph for Nb2STO/KTO and Nb4STOKTO, respectively. The slope indicates the activation energy divided by the Boltzmann constant.