# Cathodoluminescence study of oxygen vacancy migration along dislocation in $SrTiO_3$

NIMS [1], Tohoku Univ.[2] Univ. of Tsukuba[3] ○Jun Chen[1], Wei Yi[1], Peng Wang[1], Shun Ito[2], and Takashi Sekiguchi[1, 3]

E-mail: CHEN.Jun@nims.go.jp

Oxygen vacancies behave as n-type dopants in $SrTiO_3$. Previous studies have addressed the correlation between oxygen vacancies and electrical conductivity. The conductivity could be strongly varied when $SrTiO_3$ is exposed to vacuum or $O_2$ ambient. One the other hand, the extended defects (grain boundaries, dislocations, etc.) in $SrTiO_3$ may also affect the distribution of oxygen vacancies. In this study, the impact of dislocations on oxygen vacancies in un-doped $SrTiO_3$ single crystal has been investigated by cathodoluminescence (CL). The dominated luminescence peak located at ~ 2.8 eV is originated from oxygen vacancies. Enhanced luminescence has been observed at specific dislocations with the accumulation of oxygen vacancies as shown in Fig. 1. Under annealing either in oxidizing or reducing atmosphere, the diffusivity of oxygen ions at dislocation cores is nearly the same as that in the bulk [1]. CL results suggest that the accumulation of oxygen vacancies is easily triggered by certain dislocations. However, there is no significantly enhanced diffusion of oxygen vacancies along dislocations. This work may also provide a feasible way to modulate the oxygen vacancy content in oxide semiconductors.

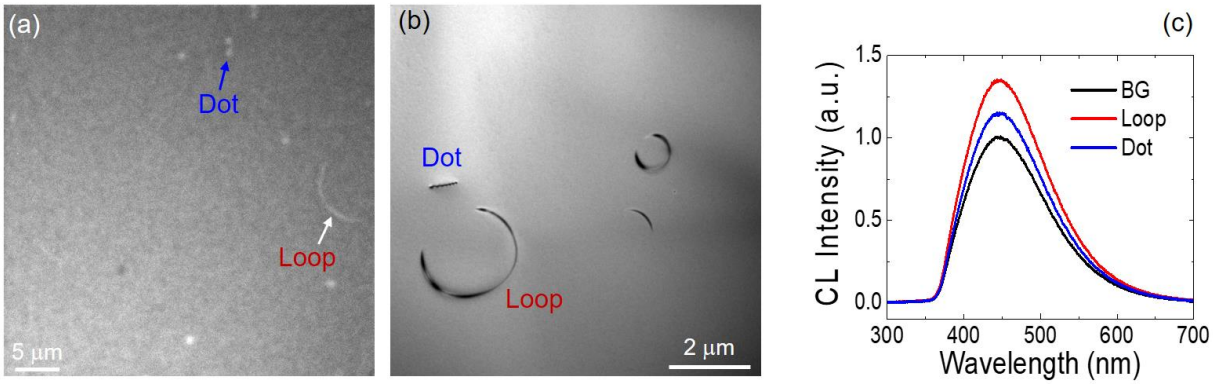


Fig. 1 (a) Monochromatic CL images of dislocation loops and dots with enhanced luminescence in $SrTiO_3$. (b) Bright-field TEM image of dislocations and loops in $SrTiO_3$. (c) CL point spectra of bright dislocations compared with the background.

**Acknowledgement** This work was supported by JSPS KAKENHI Grant Number 18K04248.

[1] P. Wang, W. Yi, J. Chen, S. Ito, C. Cui, and T. Sekiguchi, “Oxygen vacancy migration along dislocations in $SrTiO_3$ by cathodoluminescence”, Journal of Physics D: Applied Physics 52, 475103 (2019).