

Polarity analysis of ferroelectric LiTaO_3 using EBSD

LiTaO_3 is used for a substrate of SAW filter (Surface Acoustic Wave filter) installed to cell phones. The polarity and crystal orientation are important parameters to control their properties. The polarity of LiTaO_3 was determined by EBSD pattern measured using a detector with a large number of pixels.

1. The variation of EBSD pattern in different polarities

The LiTaO_3 EBSD patterns with specific zone axis (intersection of Kikuchi patterns) are different between positive and negative polarities, because of the dynamical diffraction effect.

Reference
Matthew J. Burch *et. al.*, Ultramicroscopy 173 (2017) 47-51

EBSD: Electron Back-Scattering Diffraction attached to SEM (Scanning Electron Microscope)

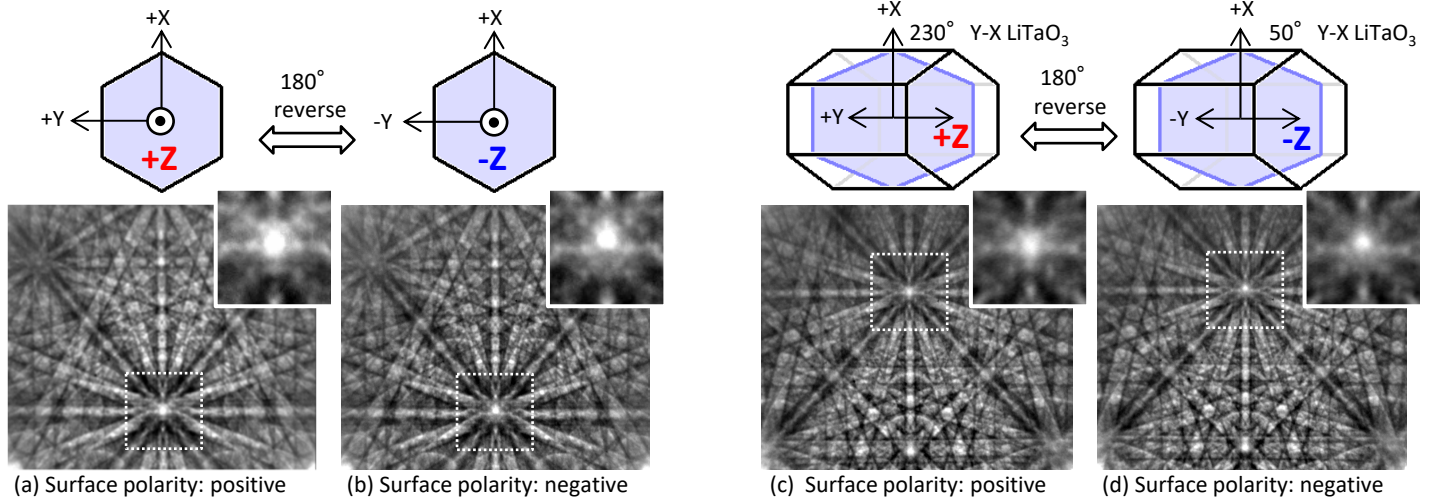
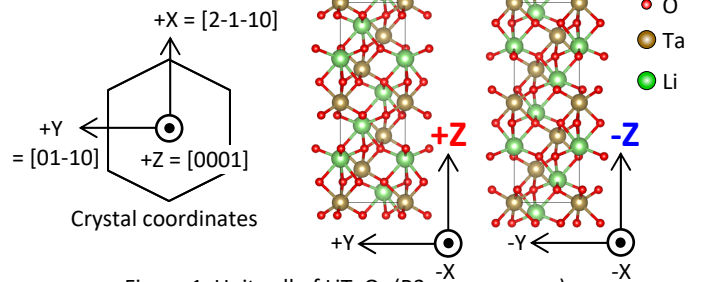


Figure 2. EBSD patterns by a LiTaO_3 standard sample with well-known polarity. (a) and (b), (c) and (d) are obtained with same zone axis, respectively. White squares are regions of interest for polarity determination.

2. Polarity determination of LiTaO_3 in SAW filter device

LiTaO_3 was evaluated after opening the package of commercially available SAW filter. The crystal orientation without polarity was identified by conventional EBSD. The surface polarity was assigned to positive by the comparison with the standard EBSD pattern in figure 2 (c).

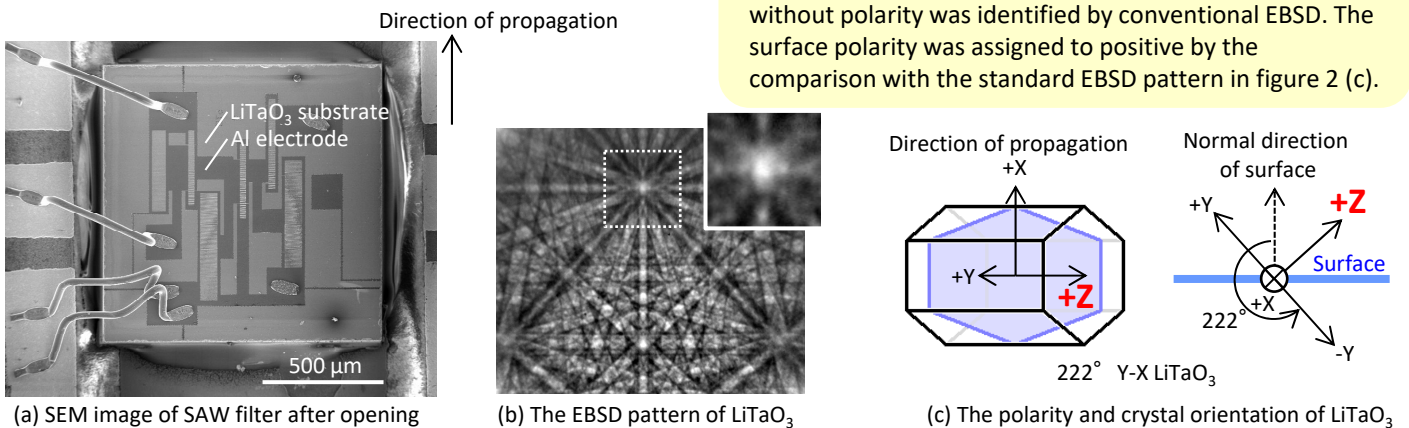


Figure 3. Results of crystal orientation and polarity analysis of LiTaO_3 in commercially available SAW filter using EBSD.

Toray Research Center can offer not only the crystal orientation but also the polarity analysis of LiTaO_3 using EBSD with a resolution of less than 100 nm !