

# Elucidation of crystal symmetry and strain of BiFeO<sub>3</sub> epitaxial films on various substrates by structural calculation and electron diffraction



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Recent resurgence of bismuth ferrite (BiFeO<sub>3</sub>) as a multiferroic materials was triggered by the revelation of its true bulk physical properties in the mid 2000s. Subsequently, multiferroic properties of BiFeO<sub>3</sub> have been found to improve when it is grown epitaxial film owing to biaxial strain applied through substrate materials. Since crystal and micro structural modifications caused by the strain dominate the multiferroic property changes in BiFeO<sub>3</sub>, tremendous efforts have been devoted to investigate structural changes in epitaxial BiFeO<sub>3</sub> film. However, details about strain-induced structural modification remain elusive due to its remarkably complex nature. In this study,<sup>1)</sup> we systematically discuss: (i) what are pros and cons between transmission electron microscopy (TEM) and X-ray diffraction (XRD) techniques, (ii) a methodology about how to apply TEM and XRD to unambiguously identify crystal symmetries in epitaxial BiFeO<sub>3</sub>, and (iii) once crystal symmetries is clearly identified, how misfit strain can be accurately evaluated. [Fig. 1]

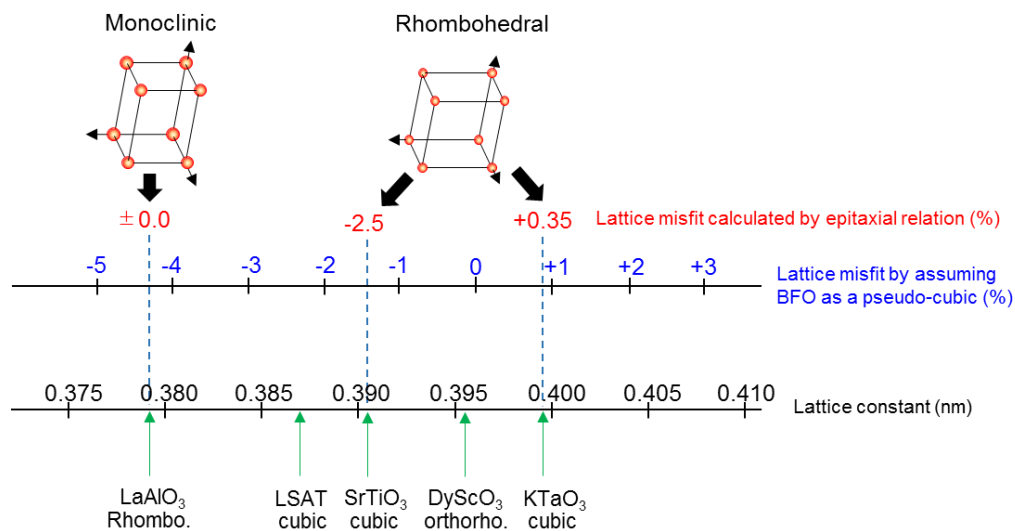


Figure 1 The lattice mismatch estimated by pseudocubic and epitaxial relation

**References:** [1] Appl. Phys. Exp., **8**, 031501 (2015), Phys. Rev. B, **93**, 064115 (2016), 日本結晶学会誌 **58**, 96 (2016), Sci. Rep., **7**, 46498 (2017), Sci. Rep., **8**, 893 (2018), Jpn. J. Appl. Phys. Selected Topics in Applied Physics (STAP), **57** (2018) *Review article free download, in-press.*

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