

Mizoguchi Lab.

Institute of Industrial Science, Dept. Mater. Envi. Science Nano-Materials Design Lab.

http://www.edge.iis.u-tokyo.ac.jp

Microscopy, Spectroscopy, and Calculation



Research in Mizoguchi Lab.

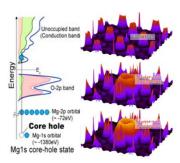
Much higher performance and higher reliability are now required to the materials to achieve further technology developments. In case of electroceramics, such as multi-layer ceramic capacitor and varistor, the size their grains in electric devices becomes smaller and smaller, ca. 1µm or less, and thus further property improvements of each grain and grain boundary are desired. To achieve this, clarification of atomic and electronic structures and finding the way to improve their properties are indispensable.

In our group, atomic and electronic structure analysis of materials are investigating by combining electron energy loss spectroscopy (EELS), transmission electron microscopy (TEM), and first principles calculation. By combining those methods, atomic and electronic structures and their relationships to materials properties can be unraveled. Particularly, superlattice, ionic liquid, Li-ion battery, silicon and electroceramics are investigated.

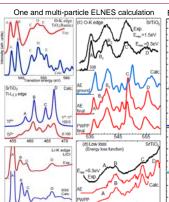
What kind of Structure? How to bring about Property?

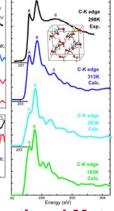
Property Structure Relationship

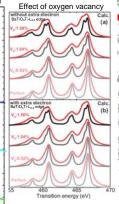
Calculation and Application of Core-loss spectroscopy (ELNES/XANES) ELNES calculation of Liquid

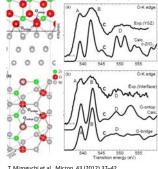


To calculate ELNES/XANES, core-hole, which is introduced in electron transition from core-orbital to conduction band, is indispensable. We are developing and applying theoretical ELNES/XANES.







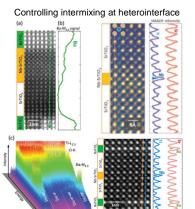


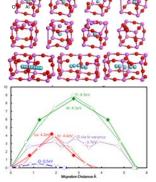
ELNES from interface

- S. Ootsuki et al., Appl. Phys. Lett., 99 (2011) 233109-1-3. Mizoguchi, J. Ceram. Soc. Jpn, 119 (2011) 325-333. T. Mizoguchi, et al., Micron, 41 (2010) 695-709 T. Mizoguchi, J. Phys.: Cond. Matter., 21 (2009) 104215-1-12. . Mizoguchi et al. Phys. Rev. B 74, (2006) 235408-1-10
- T. Mizoguchi et al. , Ultramicroscopy, 106 (2006) 1120-1128 **Defect Formation and Migration in Functional Materials**

Diffusion and defect formation in material of materials.

We are investigating those lattic mperfections using atomic resolution STEM EELS and DFT calculation to pave the way for





Lattice defects in energy materials

Order structure in Li-ion conductor

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H. S. Lee, T. Mizoguchi et al., Phys. Rev. B, 84 (2011) 195319-1-7.
T. Mizoguchi, H. Ohta, et al., Adv. Func. Mater., (2011) 21, 2258-2263
T. Mizoguchi, H. Takahashi, H. S. Lee, Appl. Phys. Lett. 98 (2011) 091909.
H. S. Lee, T. Mizoguchi, et al., Phys. Rev. B, 83 (2011) 104110-1-10
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M. Imaeda, T. Mizoguchi, et al., Phys. Rev. B, 78 (2008) 245320-1-12.