Li distribution in $Li_{0.375}Sr_{0.4375}Ta_{0.75}Zr_{0.25}O_3$ solid electrolyte mapped by vibrational electron energy loss spectroscopy

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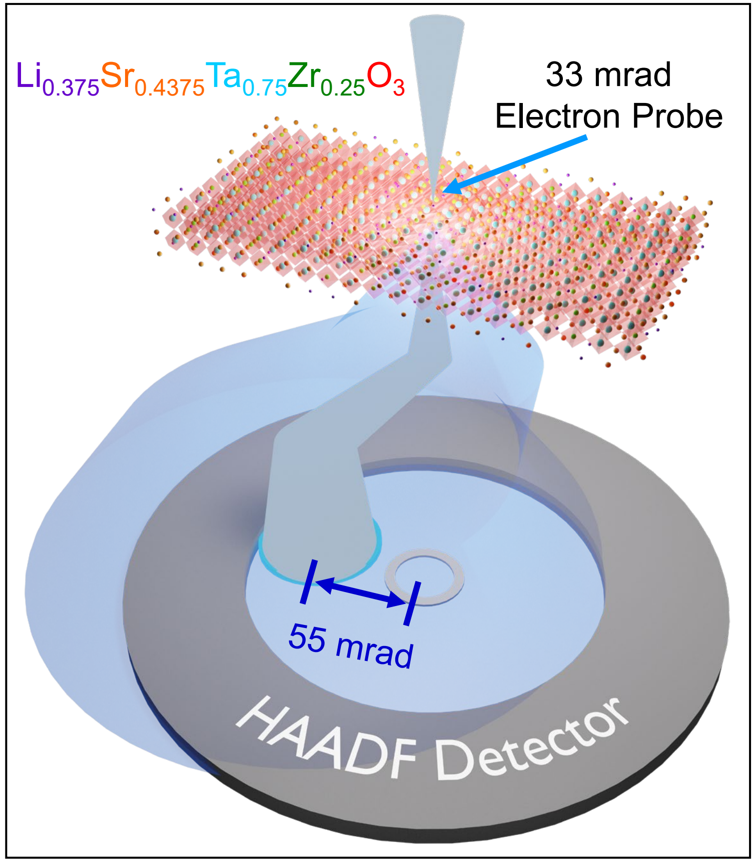
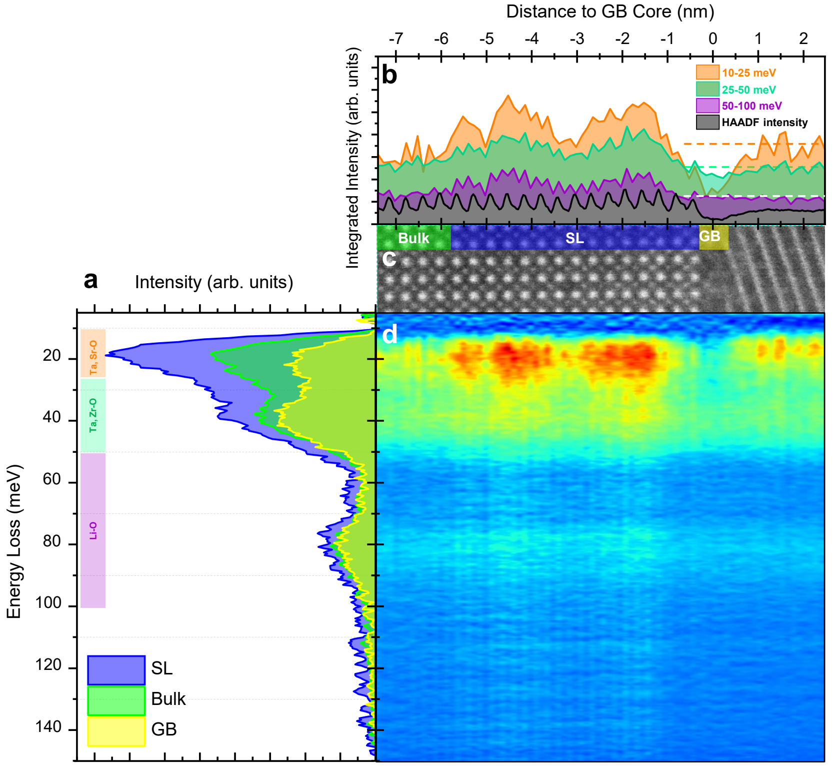
- The new Nion HERMES 200 is an aberration corrected, monochromated scanning transmission electron microscope (STEM) equipped with space- and angle-resolved electron energy loss spectroscopy (EELS), which is the first at a University Shared Facility.
- Due to the broad shape of the Ta-$O_{2,3}$ edge and its proximity to the Li-K edge, conventional coreloss EELS is unable to identify the Li-K edge of $Li_{0.375}Sr_{0.4375}Ta_{0.75}Zr_{0.25}O_3$ (LSTZ).
- To resolve this challenge, the UCI MRSEC team (Pan) employs dark field vibrational EELS (DF VibEELS), for the first time, to map the otherwise unmeasurable Li distributions in grain boundaries (GBs) of LSTZ. The team found that Li^+ concentration at GBs is the same as that inside the bulk phase, which is one key factor that attributed to the low GB resistivity of LSTZ.





Left panel: Schematic of DF VibEELS beam-detector geometry.
Right panel: Vibrational EELS data of (010) faceted grain boundary of LSTZ.

Lee T, Qi J, Gadre CA, Huyan H, Ko S, Zuo Y, Du C, Li J, Aoki T, **Wu R, Luo J, Ong SP, Pan X**. "Atomic-scale origin of the low grain-boundary resistance in perovskite solid electrolyte Li0.375Sr0.4375Ta0.75Zr0.25O3", *Nature Communications*, **14**, 1940 (2023). https://doi.org/10.1038/s41467-023-37115-6