Systematic Study of Background Subtraction Techniques for EELS

V.C. Angadi T. Walther

Department of Electronic and Electrical Engineering
University of Sheffield,
Sheffield, UK

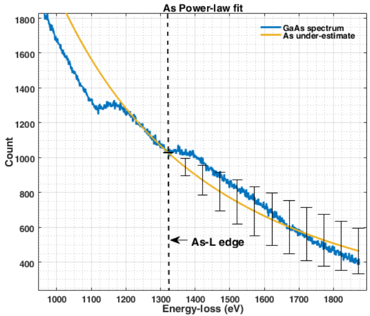
EMAG 2016 - Durham

Motivation

- EELS is a very important tool for elemental analysis of materials science.
- Net core loss $=$ spectrum $-$ background.
- extrapolating the background in the presence of preceding edges is difficult.
- Background fitting in the presence of ELNES, EXELFS etc.
- Explore extrapolation from other regions such as post-ionization edge.
- Explore extrapolations which are combination of fits in different region.

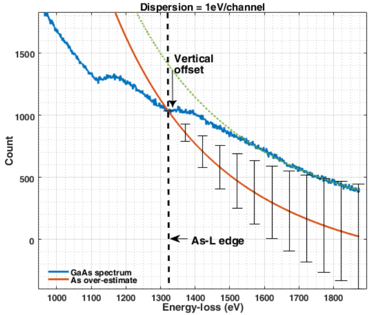
Pre-edge region

- Background crossing the spectrum -unphysical.
- As-$L_{2,3}$ edge can still be quantified by integrating only the positive core-loss region.
- This yields an under-estimate.
- The Ga-$L_{2,3}$ edge is straight forward as the it has very large pre-edge region.
- Highly associated with large systematic errors for large integration range.
- Systematic errors are difficult to identify by regression and quantification.



Post-edge region

- Extrapolate from end of the spectrum and offset vertically to cross through the edge onset.
- Over-estimate of the core-loss edge intensity.
- Poissonian statistical error bars are very large.
- Highly associated with statistical errors and are difficult to identify by regression and quantification.
- For Ga-$L_{2,3}$ edge, As-$L_{2,3}$ edge is subtracted to provide larger post-edge region for extrapolation.



Optimal fit

- Fits in pre-edge and post-edge regions provide under-and over-estimate of the core-loss edges.
- Only backgrounds which are physically meaningful are retained.
- Yields positive core-loss.
- Have smaller error bars.
- More discussions in poster **P16**.