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# Low energy electron inelastic mean free path of Zinc from XAFS using XERT techniques at room temperature.

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The electron inelastic mean free path (IMFP) is the average distance travelled between successive inelastic collision for an electron moving with a particular energy in a given material [1]. IMFP and Electron Loss Functions (ELF) are used in electron diffraction and LEED and EELS techniques where low energy inelastic scattering is dominant in electron transport. Measurements and theoretical understanding of these are also critical for Monte Carlo detector and scattering transport codes and applications. However, experimental data usually only exists at high energies. Our research work develops a unique experimental technique at the XAS beamline for determining low energy electron inelastic mean free path of photoelectrons with high accuracy XAFS measurements.

There are significant discrepancies between theoretical and experimental IMFPs. Resolution of these discrepancies requires a series of high accuracy experimental XAFS measurements. Our group has developed the X-ray extended range technique (XERT) to obtain precise XAFS measurements. In this work, precise XAFS measurements of zinc metal at room temperature were collected at the Australian Synchrotron. We are able to diagnose and correct for most systematic errors such as dark current, thickness, scattering linearity etc. Our high accurate data sets permit the determination of beam-line independent, critical measurements of IMFPs.

Using these high quality data and with the technique developed to measure low energy based on the coupled plasmon models by Chantler and Bourke, room temperature low energy electron inelastic mean free paths of Zinc will be calculated. This will answer questions about the interaction of photoelectron with condensed systems. It will investigate the scaling of the theoretical curves which have often been said to follow a 'Universal Curve' despite different theory predicting different universal curves. It will also investigate the relevance of coupling of plasmon resonances in the theory and experiment, and the possible influence of correlation as has been discussed by several authors recently.

References:
[1] Schalken MJ, Chantler, CT (2018) Synch. Rad. Vol25-4 920-934

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