Absolutely Scaled Mass Attenuation Coefficients for Tin between 29 and 60 keV

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Introduction

We have performed a measurement of the mass attenuation coefficient of tin from 29 to 60 keV, thus including the K absorption edge. The experiment was performed by following the x-ray extended range technique (XERT) [1], which allows for the detection of a number of sources of systematic error that have invalidated the results of a number of previous measurements [2, 3]. Measurements over the absorption edge were taken at approximately 1-eV intervals, to appropriately reveal the structure in the mass attenuation coefficient in the x-ray absorption fine structure (XAFS) region.

Methods and Materials

The work was performed at BESSRC beamline 12-BM at the APS. In order to produce the high-energy x-rays used in this experiment, we applied further monochromation to the beam after its passage through the primary monochromator. Thus, the fixed monochromator was operated in third-order mode, and a second, in-hutch monochromator was operated in fourth-order mode, to remove the unwanted (harmonic) components and furthermore to reduce the effect of the bandwidth of the beam on the measured attenuations on the absorption edge.

The measurements will be processed to determine the mass attenuation coefficient on an absolute scale, to an anticipated accuracy of better than around 0.2%. These results will be used to critically examine different theoretical models and experimental techniques.

Results

Preliminary results are shown in Fig. 1 in the neighborhood of the absorption edge. Results of measurements taken in the XAFS region will be used to critically examine the assumptions of current XAFS analysis and to make use of the extra information available with absolutely scaled data.

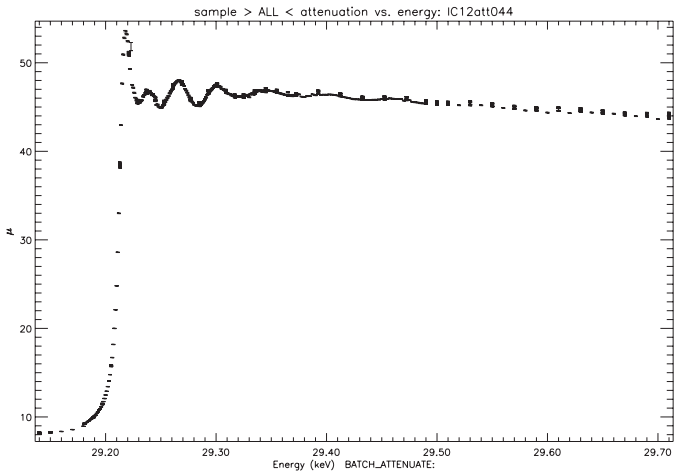

FIG. 1. Near-edge detail of the mass attenuation coefficient of tin. The measurements are absolutely scaled and thus can, in principle, be used to test all processes contributing to x-ray attenuation. The data are collected on a grid that is commensurate with the structure in the mass attenuation coefficient, reaching 1 eV on and immediately above the absorption edge.

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References

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