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Opportunities for a greater spectroscopy DCM - vibration study

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X-ray absorption spectroscopy (XAS) is a technique that typically challenges the performance of its monochromator. The XAS Beamline at the Australian Synchrotron utilises a commercially delivered liquid Nitrogen cooled double crystal monochromator (DCM). This DCM possesses excellent energy and beam offset stability. Some mechanical and electrical improvements have been made in-house to enhance performance for the beamline's science user community. Further improvements to the DCM are strongly motivated by the research needs of the user community, for eg materials and systems where a metal species of interest is present at very low concentrations (few 100 ppb).

For any DCM data quality can be limited by vibrations between the two diffracting crystal surfaces, resulting in beam 'noise' via positional changes, flux intensity perturbations and possibly small energy changes. As such, effort is invested to reduce current DCM crystal vibrations (~400-1000 nRad) to increase system performance and satisfy user community needs.

Herein we report an in-situ (with X-ray beam and a position sensitive ion chamber) and ex-situ (with accelerometers) characterisation of the vibrational response of the DCM at the XAS Beamline. In general, the X-ray beam shows a vibration spectrum closely resembling the measured resonant frequencies of the DCM components, as well as the superposition of the floor dynamics. The effect of rubber damping pads, stiffened supporting structures and other modifications will be presented, and ideas and strategies for improved vibrational performance will be discussed.

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