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High Resolution Imaging and Strain Characterisation at Pulsed Neutron Sources with a Microchannel plate detector

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Recent advances in neutron detection technology are enabling collection of neutron transmission data with unprecedented spatial and time resolution [1,2]. Microchannel plates coupled with TimePix area detectors are now being used to perform time-of-flight neutron radiography experiments at $55\text{ }\mu\text{m}^2$ spatial resolution and $1\text{ }\mu\text{s}$ temporal resolution. These sensors are suited to a diverse range of neutron studies such as microtomography of material composition or phase and strain tomography [2,3,4].

In neutron time-of-flight transmission experiments each neutron arriving at the detector is tagged with its arrival time, this allows the determination of the energy-resolved transmission spectrum from the known time structure of the incident pulse. Variation of these transmission spectra can be used to obtain spatially-resolved maps of projected crystallographic properties within polycrystalline materials; such as average elastic strain, plastic strain, texture and grain size distributions. Here, we present results from a recent experiment at the Engin-X beamline, ISIS, UK. The transmission spectrum of an additively manufactured jet engine turbine blade was measured and used to determine spatially-resolved maps of the average elastic strain in the transmission direction. This is a sample of intrinsic scientific interest due to questions that remain about the residual strains imparted during fabrication compared to those manufactured conventionally.

- [1] Tremsin et al. Nuc. Instr. Meth. Phys. A 2012
- [2] Zhang et al. Mat. Today 2009
- [3] Abbey et al. Procedia Engineering 2009
- [4] Kirkwood et al. Trans. American Crystallographic Association 2013

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Primary author: Mr KIRKWOOD, Henry (ARC COE Advanced Molecular Imaging - La Trobe University)

Co-authors: Prof. KORSUNSKY, Alexander (Oxford University, Oxford, UK); Dr TREMSIN, Anton (Space Sciences Laboratory, University of California, Berkely, USA); Dr ABBEY, Brian (ARC COE Advanced Molecular Imaging); Dr ZHANG, Shu Yan (Science & Technology Facilities Council, Rutherford Appleton Laboratory, Harwell, Oxfordshire, UK)

Presenter: Mr KIRKWOOD, Henry (ARC COE Advanced Molecular Imaging - La Trobe University)

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