A New, Rapid 3D Tomographic Energy Dispersive Diffraction Imaging System for Materials Characterisation and Object Imaging (Rapid TEDDI)

Kern Khor, Robert Cernik, *School of Materials, Manchester, UK and Daresbury Laboratory, Warrington, UK.* E-mail: r.j.cernik@dl.ac.uk

In 1998 Hall et al [1] demonstrated that the interior features of solid objects could be very effectively and simply imaged in a non-destructive manner using synchrotron energy dispersive diffraction. They were able to demonstrate big improvements over the measurements obtained by Harding [2] who used conventional rotating anode X-ray sources. Both papers demonstrate the huge potential of (TEDDI) in materials science. Although there are many forms of tomo-graphic imaging, virtually all rely on absorptive or spectroscopic responses of a material object to invading radiation. By contrast TEDDI is unique in using both diffraction and absorption or diffraction and spectroscopic data. A white beam from a synchrotron or laboratory X-ray source is collimated to the desired spatial resolution. The small diffracting sample volume is defined by the track of the incident and scattered beams through the sample and the angle subtended by the collimator aperture. The sample is scanned in 3 dimensions in small steps. This is, however, a very time consuming process. As a consequence we are developing array solid state detectors with corresponding collimator arrays that can reduce the time for object scamming from 14 hours to a few minutes. In this way a 3D density contrast map will be obtained with full structural and chemical information at each voxel point. This development will be explained in more detail in the context of a wide range of diverse applications.

[1] Hall C., Barnes P., et al, *Nuclear Instruments & Methods in Physics Research Section B-beam interactions with materials and atoms* , 1998, **140**, 253-257. [2] Harding G, et al, *Physics in Medicine and Biology*, 1990, **35** ,33-41.

Keywords: synchrotron, materials, tomography