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3D imaging of particle tracks in Solid State Nuclear Track Detectors

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Inhalation of radon gas (222Rn) and associated ionizing decay products is known to cause lung cancer in human. In the U.K., it has been suggested that 3 to 5 % of total lung cancer deaths can be linked to elevated radon concentrations in the home and/or workplace. Radon monitoring in buildings is therefore routinely undertaken in areas of known risk. Indeed, some organisations such as the Radon Council in the UK and the Environmental Protection Agency in the USA, advocate a ‘to test is best’ policy. Radon gas occurs naturally, emanating from the decay of 238U in rock and soils. Its concentration can be measured using CR?39 plastic detectors which conventionally are assessed by 2D image analysis of the surface; however there can be some variation in outcomes / readings even in closely spaced detectors. A number of radon measurement methods are currently in use (for examples, activated carbon and electrets) but the most widely used are CR?39 solid state nuclear track?etch detectors (SSNTDs). In this technique, heavily ionizing alpha particles leave tracks in the form of radiation damage (via interaction between alpha particles and the atoms making up the CR?39 polymer). 3D imaging of the tracks has the potential to provide information relating to angle and energy of alpha particles but this could be time consuming. Here we describe a new method for rapid high resolution 3D imaging of SSNTDs. A ‘LEXT’ OLS3100 confocal laser scanning microscope was used in confocal mode to successfully obtain 3D image data on four CR?39 plastic detectors. 3D visualisation and image analysis enabled characterisation of track features. This method may provide a means of rapid and detailed 3D analysis of SSNTDs.

Keywords: Radon; SSNTDs; confocal laser scanning microscope; 3D imaging; LEXT