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Solid state nuclear track detectors for radon exposure-dose measurements and the application of confocal imaging for 3D visualisation of tracks

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Inhalation of radon gas (222Rn and its associated radioactive heavy metallic daughter products) is estimated to cause 1100 UK lung cancer related deaths per year (Gray et al. 2009). Radon exposure can significantly increase the risk of lung cancer in smokers as well as non-smokers. Accurate and timely assessment of radon levels is thus important in areas with known elevated radon risk to be able to institute remedial procedures. Radon is colourless and odourless and so its presence could remain undetected without the use of appropriate sensing technology.

A common method for monitoring radon concentration is with solid state nuclear track detectors (SSNTDs). These integrative passive detectors often consist of a CR39 detector inside a chamber / container which has a suitable passageway for radon to enter. The chamber shelters the detector and contains a volume large enough to record the number of alpha particle emissions over a period of time. Other detection methods include continuous active devices but there is a wide variety of detector types available such as electrets, charcoal, thermoluminescent phosphors, silicon diodes / barrier chips, and ion chambers. SSNTDs though are commonly used in the UK.

Confocal microscopy has previously been used to examine fission tracks in mica and apatite. We have developed methods for 3D image analysis and visualisation of radon tracks in SSNTDs using confocal microscopy (Wertheim et al. 2010, Wertheim and Gillmore, 2014, Gillmore et al. 2017). There can be some variation in track diameters with results from our work indicating that typical median (range) equivalent track diameter for single tracks is 46.1 (20.05 to 62.44) μm for standard processing (Wertheim et al. 2010). Olympus LEXT confocal microscopes have been used to image tracks and the results have shown that tracks can have different size, shape and impact angle. In addition we identified that tracks in close proximity can coalesce into a cluster with complex shapes; such clusters may be difficult for 2D image analysis to distinguish from artefact. 3D imaging allows distinction of real tracks from artefact as the full 3D extent can be ascertained from the visualisation rather than just a surface image.

References

Gillmore G., Wertheim D., Crust, S., 2017. Effects of etching time on alpha tracks in Solid State Nuclear Track Detectors. Science of the Total Environment, 575: 905-909.
Gray A. et al., 2009. Lung cancer deaths from indoor radon. British Medical Journal, 338:a3110.
Wertheim, D., Gillmore, G., Brown, L., Petford, N., 2010. A new method of imaging particle tracks in Solid State Nuclear Track Detectors. Journal of Microscopy, 237, 1–6.
Wertheim, D., Gillmore, G., 2014. Application of confocal microscopy for surface and volume imaging of solid state nuclear track detectors. Journal of Microscopy, 254, 42-46.