Geophysical Research Abstracts
Vol. 15, EGU2013-10388, 2013
EGU General Assembly 2013

Effects of etching time on alpha tracks in Solid state Nuclear Track Detectors

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Inhalation of radon gas is thought to be the cause of about 1100 lung cancer related deaths each year in the UK (1). Radon concentrations can be monitored using Solid State Nuclear Track Detectors (SSNTDs) as the natural decay of radon results in alpha particles which form tracks in the detectors and these tracks can be etched in order to enable microscopic analysis. We have previously shown that confocal microscopy can be used for 3D visualisation of etched SSNTDs (2, 3). The aim of the study was to examine the effect of etching time on the appearance of alpha tracks in SSNTDs. Six SSNTDs were placed in a chamber with a luminous dial watch for a fixed period. The detectors were etched for between 30 minutes and 4.5 hours using 6M NaOH at a temperature of 90oC. A 'LEXT' OLS4000 confocal laser scanning microscope (Olympus Corporation, Japan) was used to acquire 2D and 3D image datasets of CR-39 plastic SSNTDs. Confocal microscope 3D images were acquired using a x50 or x100 objective lens. Data were saved as images and also spreadsheet files with height measurements. Software was written using MATLAB (The MathWorks Inc., USA) to analyse the height data. Comparing the 30 minute and 4 hour etching time detectors, we observed that there were marked differences in track area; the lower the etching time the smaller the track area. The degree to which etching may prevent visualising adjacent tracks also requires further study as it is possible that etching could result in some tracks being subsumed in other tracks. On the other hand if there is too little etching, track sizes would be reduced and hence could be more difficult to image; thus there is a balance required to obtain suitable measurement accuracy.

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