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Artificial formation of alpha recoil tracks using an americium source

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Alpha recoil track (ART) is a lattice defect formed by the alpha decay of heavy nuclides. It is necessary to investigate appropriate etching conditions, surface properties of a mineral, and the ART annealing characteristics upon heating to apply ART observation to the dating and thermal history study of various minerals. This study aims to develop a method for artificially forming ART so that the shape and properties of etched ART in various minerals can be studied in the future.
A 300 Bq americium source was used to irradiate muscovite, in which the ARTs were well observed in previous studies, for various time intervals after annealing treatment to erase all naturally occurring ARTs, and the samples were observed using phase contrast microscopy after chemical etching. The ART areal density formed on the sample surface showed a linear relationship against irradiation time, indicating the feasibility of using Am source to artificially form ARTs on a mineral surface. However, the size distribution of the artificial ARTs were larger than that the naturally observed ARTs.
The annealing experiment on the artificially formed ARTs showed that the size distribution of natural ARTs could be indicative of annealing at ambient temperature over a geologically long period time, or ARTs could have been annealed in the recent past at a slightly higher temperature (150 −200℃) given their uniform size distribution. We cannot rule out the possibility that the observed natural ART-like tracks were formed by the movement of smaller nuclei (e.g., movement of major mineral-forming-atoms by cosmic ray irradiation),assuming that the track size reflects the energy and mass of moved nuclei. Further detailed studies of annealing behavior and track formation processes by the movement of various atoms are required to reach a definitive understanding.

Do you plan to give the talk in person?

Yes

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