Identification of Radioactive Isotope from the Alpha Particles Ranges

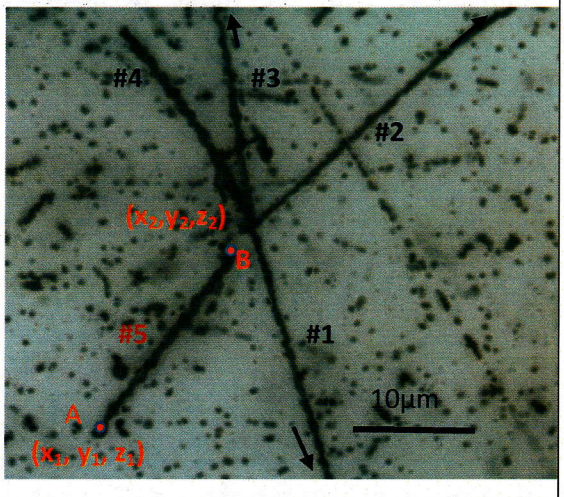
The identification of the radioactive isotopes is possible, in principle, from the alpha particle ranges. The concept of the residual range is one that is quite important in emulsion analysis. The residual range, R, is the average distance that a particle with a given velocity has to go before coming to rest. It is a track variable that rises with the velocity, momentum and energy. The residual range is an ideal distance or it is the expectation value of the path length required to bring the particle to rest. Since the present emulsion is mounted pellicles, we need to consider shrinkage factor only in z axis (S_z = S) which means ($S_x \approx S_y \approx 1$). When the emulsion shrinks only in the z direction, the range is obtained from the following formula

$$R = \sum_{i=1}^{n} \left[(x_i - x_{i-1})^2 + (y_i - y_{i-1})^2 + S^2 (z_i - z_{i-1})^2 \right]^{1/2} \quad (1)$$

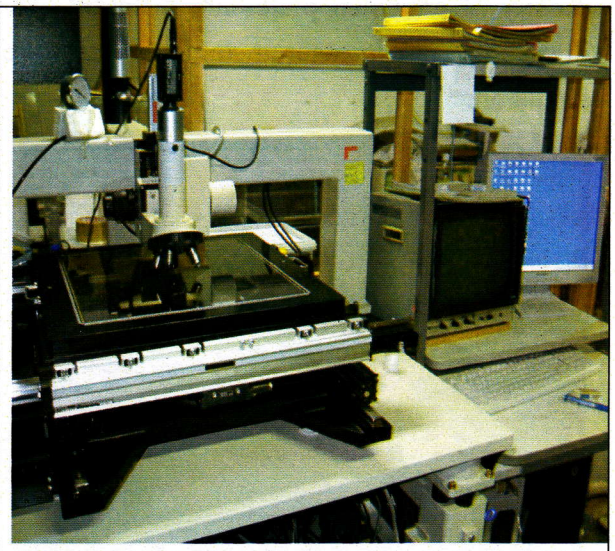
Range of alpha particles can be measured by using the microscope system. The measured point on a track and microscope system are shown in Fig. 5. If we know the coordinates at point A (x_1, y_1, z_1), and point B (x_2, y_2. z_2), range of track #5 can be obtained by using Equation (2). Range of other alpha particle tracks in Thorium and Uranium series are measured with the same manner as explained in above.

$$R = \left[(x_2 - x_1)^2 + (y_2 - y_1)^2 + S^2 (z_2 - z_1)^2 \right]^{1/2} \quad (2)$$

In above equations S express the Shrinkage factor which is the thickness ratio of emulsion at the time of beam exposure to the present time.



(i) A Photograph of Thorium series in two dimensional view



(ii) Microscope system for measurement of range of particle tracks

Fig. 5. The photograph of a Thorium series in nuclear emulsion and microscope system