FRACTAL METHODS IN RADIOACTIVITY MEASUREMENTS

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Abstract

In this talk we describe the basic concepts of fractal geometry (Mandelbrot, 1983) and show how they can be connected to radioactivity measurements. Two applications are covered: distribution of radioactivity in environment as well as radon emanation phenomenon.

A model based on fractal geometry of surfaces has been developed to describe distribution of radioactivity in the natural environment (Semkow, 1995). The model is fitted to two sets of literature data on radioactivity distribution in coal fly ash particles and three sets of data for soil particles. While different processes determine the radioactivity distribution in fly ash and soil, the net effect is often an enhancement or in some cases a decrease of concentration of radioactive elements on the surfaces of particles. In all cases studied it was possible to determine the fractal dimension of the particle surface as a measure of its roughness, as well as the internal radioactivity concentration. In some cases it was possible to determine the surface concentration of radioactive elements as well as an average thickness of the surface layer. In this way the fractal-particle model is useful in elucidating the key parameters that determine interaction of particles with the environment and corresponding fate of natural radionuclides.

Radon emanation is another phenomenon which depends on the roughness of the surface as well as on the distribution of radium. Using especially developed fractal model (Semkow, 1991; Semkow *et al.* 1991), we show how the radon emanating power varies with particle roughness and diameter for different assumed distribution of radium. In several cases one can determine the fractal dimension of the surface by fitting the model to available experimental data.

The talk is concluded by proposing new experiments to study roughness of environmental particles using radioactive tracers.

References

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