Development of a single-reservoir radial diffusion test for cylindrical specimens

Mikio Takeda[1]; Ming Zhang[1]; Hideo Nakajima[1]

[1] Research Center for Deep Geological Environments, AIST

Accurate characterization of the diffusive and adsorptive properties of geological, geotechnical, and synthetic materials are indispensable for the design and assessment of engineered and/or natural barrier systems for geological disposal of hazardous contaminants including radioactive nuclear wastes.

Although many types of diffusion test are currently available for determining the diffusive and adsorptive properties of geological materials, most methods require relatively tedious experimental procedures and long experimental time, especially when the diffusive coefficient of a test specimen is low and/or the absorbing property of tracer is strong. To treat with these problems, a radial diffusion test for cylindrical specimens is developed, and the corresponding analytical solution is derived. The analytical solution are then used to exam 1) if and how the experimental duration can be shortened; 2) how to obtain higher sensitive measurement data and thus higher accuracy of diffusive and adsorptive parameters from a test.

The theoretical examinations in this paper demonstrated the following advantages of the radial diffusion test over the conventional diffusion tests: 1) simple test procedure allowing and measuring the transient variations of solute concentration in the source reservoir; 2) short experimental duration for obtaining measurement data; 3) simultaneous determination of the diffusive and adsorptive properties in virtue of transient data analysis.