Experimental study on thermal properties of the bentonite-sand mixed buffer backfill materials

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Abstract: In order to improve the thermal performance of the buffer backfill materials in the high-level radioactive waste geological repository, the Gaomiaozi sodium bentonite (N) and calcium bentonite (G) are selected as basic materials which are mixed with various proportions of quartz sand, graphite, and zeolite to form the mixed buffer backfill materials. Their thermal conductivities under conditions of various moisture contents and dry densities have been measured by using transient plane heat source method. The recommended mix ratio of the mixed buffer backfill material has been proposed in this paper. The test results show that the thermal conductivities of the buffer backfill materials are increased with the increase of their water contents and dry densities. The thermal conductivities of various materials are decreased in following order from graphite (M), quartz sand (S), sodium bentonite (N), calcium bentonite (G), to zeolite (F). The thermal conductivities of buffer backfill materials can be greatly improved with the addition of quartz sand and graphite as their additives. Zeolite has little effect on the thermal conductivities of the buffer backfill materials, but its excellent adsorption capacity and chemical stability can provide guarantee for other properties of the mixed buffer backfill materials.

Keywords: mixed buffer backfill material; bentonite; transient plane heat source method; thermal conductivity