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论文

砂-膨润土混合屏障材料渗透性影响因素研究

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摘要:

膨润土因具有渗透性低、阳离子交换能力高等优点被认为是最适合高放废物深地质处置库中屏障系统的缓冲材料,工程实践发现随着水化过程的进行,纯高压实膨润土强度不断降低,并最终影响到工程屏障系统功能的发挥。针对这一问题,在膨润土中加入一定比例的石英砂,可以有效地提高工程屏障的热传导特性、压实性、力学强度和长期稳定性,降低工程造价。本文研究了影响砂 膨润土混合物渗透性的主要因素,包括膨润土含量、粒径分布、含水量和干密度、压实方法以及膨润土类型等。结果表明,砂土混合物渗透性主要受膨润土的渗透性控制,渗透系数随着膨润土含量和干密度的增加而减小,当膨润土含量超过某一界限值后,继续增加膨润土含量对降低渗透系数的作用有限; 细颗粒和级配良好的混合物渗透系数小,当土体内部发生渗透侵蚀将增大渗透系数; 最优含水量条件下压实得到的渗透系数最低,高于最优含水量压实得到的渗透系数比低于最优含水量压实得到的渗透系数要小。

关键词: 砂-膨润土混合物,放射性废料,缓冲材料,渗透性,膨润土

INFLUENCE FACTORS OF SAND BENTONITE MIXTURES ON HYDRAULIC CONDUCTIVITY

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Abstract:

Bentonite is attracting a greater attention as buffer and backfill material of the engineering barrier for geological disposal of high level radioactive nuclear waste,because it can offer impermeability and swelling properties. But the pure compacted bentonite strength decreases with increasing hydration,which will reduce the buffer capability in the practice engineering. To solve this problem,sand is often used to form compacted sand bentomite mixtures(SBMs)to provide high thermal conductivity,excellent compaction capacity,long time stability,and low engineering cost. The factors affecting the hydraulic conductivity of SBMs are studied in this paper. They include bentonite content,grain size distribution,moisture content,dry density,compacting method and energy,and bentonite type. The studies show that the hydraulic conductivity of SBMs is controlled by the hydraulic conductivity of the bentonite. It also decreases as dry density and bentonite content increase. But when the bentonite content reaches a critical point,the influence of increasing bentonite to decrease the hydraulic conductivity is limited. A fine and well graded SBM is likely to have a lower hydraulic conductivity than a coarse and poorly graded material. The internal erosion or erodibility based on the grain size distribution of the SBMs has a negative effect on the final hydraulic conductivity. The lowest hydraulic conductivity is gained when the mixtures are compacted close to optimum moisture content. Also,the mixtures compacted at moisture contents slightly above optimum values give lower hydraulic conductivity than when compacted at slightly under the optimum moisture content.

Keywords: Sand bentonite mixtures, Radio active waste, Buffer material, Hydraulic conductivity, Bentonite

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