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高碱性溶液对高庙子膨润土溶蚀作用的研究

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GEOCHEMICAL INTERACTIONS BETWEEN COMPACTED GAOMIAOZI BENTONITE AND HYPER-ALKALINE SOLUTION

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摘要 在高放性核废物地质处置库中，碱性孔隙水长期入渗可能会对膨润土的缓冲封闭性能产生不良影响。为了研究高碱性溶液对膨润土的溶蚀作用及其机制，本文用NaOH溶液模拟高碱性孔隙水，对初始干密度为1.70 g/cm3的高庙子膨润土试样进行渗透侵蚀，并借助X射线衍射(XRD)和能谱分析(EDS)测试，对侵蚀后各试样的矿物成分和Mg元素含量的变化进行测定分析。结果表明：高庙子膨润土含有蒙脱石、石英、斜长石和微斜长石(或方石英)，且主要有效组分为蒙脱石；在试验过程中，经高碱性溶液的侵蚀，试样的主要原生矿物的种类没有减少，也没有检测到新物质生成，但膨润土试样中的蒙脱石和Mg元素的含量随着侵蚀碱性溶液浓度的增大而降低，这说明在高碱性溶液的侵蚀作用下，膨润土中的蒙脱石发生溶解。因此，碱性孔隙水的长期入渗会对膨润土产生溶蚀作用，进而降低膨润土的膨胀性能，增大膨润土的有效孔隙比和渗透性，最终削弱了膨润土的缓冲封闭性能。

关键词： 土力学 膨润土 高碱性 X射线衍射 蒙脱石 溶蚀

Abstract： The high-alkaline pore fluid may affect buffer and sealing properties of bentonite during a long-term period in the geological radioactive waste repository. In order to investigate the dissolution and its mechanism of bentonite by hyper-alkaline pore water，the permeability and erosion tests，in which NaOH solutions is used to simulate the hyper-alkaline pore water，are carried out for the compacted Gaomiaozi bentonite samples with an initial dry density of 1.70 g/cm3；then X-ray diffraction(XRD) and energy dispersive spectrometer(EDS) are applied to investigate the alteration of mineral components and Mg content of samples. Test results present that：(1) Montmorillonite，quartz，albite and microcline(or cristobalite) are components of Gaomiaozi bentonite；and montmorillonite is the main effective component. (2) No original minerals vanish and secondary minerals produce are observed during the experiments simulating period，but values of montmorillonite and Mg content of bentonite samples decrease with the increase of concentration of the hyper-alkaline solution，which indicates the dissolution of montmorillonite under the erosion of the hyper-alkaline solutions. Therefore，under long-term infiltration of hyper-alkaline pore water，bentonite dissolves，which results in the reduce of the swelling potential，amplification of the effective porosity and permeability，and finally the buffer and sealing capability of bentonite dropping.

Keywords： soil mechanics bentonite hyper-alkaline X-ray diffraction montmorillonite dissolution