

Effects of γ -rays irradiation aging on the mechanical strength and swelling properties of natural GMZ sodium bentonite

*Mao Haijun¹, Liu Peng², Yang Chunhe¹, Yang Zhongtian³, Wang Guibin¹, Liu Wei³

*Haijun Mao¹, Peng Liu², Chunhe Yang¹, Zhongtian Yang³, Guibin Wang¹, Wei Liu³

1. State Key Laboratory of Geomechanics and Geotechnical Engineering, Institute of Rock and Soil Mechanics, Chinese Academy of Sciences, 2. School of Civil Engineering and Architecture, Southwest University of Science and Technology, 3. China Institute for Radiation Protection

1. State Key Laboratory of Geomechanics and Geotechnical Engineering, Institute of Rock and Soil Mechanics, Chinese Academy of Sciences, 2. School of Civil Engineering and Architecture, Southwest University of Science and Technology, 3. China Institute for Radiation Protection

Bentonite was often used as the back filling materials in high-level radioactive waste geological disposal. In order to study the effect of gamma irradiation on the mechanical strength and swelling properties, some experiments were taken on the natural sodium bentonite, from Gaomiaozi (GMZ), Inner Mongolia. The bentonite samples were performed at different cumulative doses of electron irradiation aging at room temperature firstly. Then by D8 Advance X-ray diffraction, the mineral composition of bentonite was detected and analyzed. And then triaxial shear test and swelling test were conducted to study the evolution law of the mechanical strength and deformation characteristics before and after irradiation. Results showed that mineral components changed after γ -rays irradiation in bentonite. The microstructure of montmorillonite changed and transformed to the stable silicate and aluminosilicate minerals. After irradiation, with the increase of the irradiation dosage under the same confining pressure, the shear strength of bentonite increased, and the peak shear strength of bentonite had gradually increased, due to the change in the mineral composition. With the increase of confining pressure, the strength increase trend gradually slow, and the effect of irradiation dose on the strength turned to be weaken, which indicates that the confining pressure inhibited the strength growth of bentonite. Due to the decrease of montmorillonite content after different irradiation effects, the expansion force of bentonite was also weakened in logarithmic law. The free expansion and loaded expansion strain decreased in different ratios. The expansion deformation ratio decreased slowly till it reached to a constant.

キーワード : irradiation aging, Na-bentonite, montmorillonite, mechanical strength, swelling property
Keywords: irradiation aging, Na-bentonite, montmorillonite, mechanical strength, swelling property