MODELLING OF TEMPERATURE-CONTROLLED TRIAXIAL COMPRESSION TESTS TO SUPPORT ANALYSIS OF CALLOVO-OXFORDIAN ARGILLITE BEHAVIOR

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For certain time period the host rock of the geological repository for high level radioactive waste will be under elevated temperature conditions. Therefore predictions of disposal system evolution in time requires deep knowledge of material properties and its behaviour under different temperature and mechanical conditions. As a part of research activities within European joint programme EURAD work package “Influence of temperature on clay based material behaviour (HITEC)”, LEI modelled laboratory experiments which had been performed by Universite de Lorraine (France). These triaxial tests of Callovo-Oxfordian (COx) rock were carried out at different temperatures (20°C, 40°C, 60°C and 80°C) and at different confining pressures (0 MPa, 4 MPa and 12 MPa). In the experiments, the samples were loaded mechanically in two directions: when the direction of the applied load is parallel to the bedding direction and when it is perpendicular to the bedding direction in the sample. The purpose of modelling laboratory experiments was to derive the values of the numerical model parameters such as initial yield stress, hardening modulus used in developed elastoplastic model based on Drucker-Prager soil plasticity model. Temperature dependency of these parameters was analysed too. Since compression and temperature caused increase in pore pressure was allowed to dissipate, heat and water flow was not modelled. For the description of material mechanical behaviour, a numerical 2D axisymmetric model in COMSOL Multiphysics (USA) was developed. Experimentally determined peak strength decrease with temperature was successfully modelled considering linear decrease of hardening modulus with temperature. Linear decrease of initial stress with temperature was determined for tests without confinement (Pc=0 MPa) while no temperature dependency for confined conditions was observed. Based on the modelling results, a set of parameters for elastoplastic model was compiled for modelling of thermo-hydro-mechanical response of COx material in-situ experiment ALC1605.

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