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高放废物工程屏障的热－水－力耦合作用分析

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摘要 采用多相多类方法，提出热－水－力耦合作用分析的综合模型。分析考虑多孔介质的三相(固、液、气)和三类(矿物、水分、空气)模型，该模型是根据控制方程、本构关系和平衡条件来建立的；并提出用于模拟高放废物地下处置体系附近场地性状的热－水－力耦合分析通用程序。热－水－力耦合分析可将工程屏障中不同过程间发生的主要相互作用，以及附近岩石的散热和水化现象都考虑进去。通过试验结果的验证，得出一些关于热－水－力方面的重要结论。

关键词 高放废物 热－水－力分析 耦合分析 工程屏障

分类号

COUPLED THERMO-HYDRO-MECHANICAL ANALYSIS OF ENGINEERED BARRIERS FOR HIGH-LEVEL RADIOACTIVE WASTE

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Abstract

A general formulation for the performance of coupled thermo-hydro-mechanical(THM) analysis is presented. A multi-phase and multi-species approach has been adopted for the development of the formulation. The analysis considers a porous material with three phases(solid，liquid and gas) and three species(mineral，water and air). The formulation is presented in terms of governing equations，constitutive laws and equilibrium restrictions. An extensive programme of coupled THM analyses simulating the behaviour of the near field in a scheme for the underground disposal of high level radioactive waste is presented. The analyses are able to take into account the main interactions between the various processes that occur in the engineered barrier and immediately adjacent rock associated with heating and hydration phenomena. Examination of the results leads to a series of significant conclusions concerning the thermal，hydraulic and mechanical aspects of the problem.

Key words high-level radioactive waste thermo-hydro-mechanical(THM) analysis coupled analysis engineered barriers

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