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岩石应力 - 水力 - 化学耦合过程研究进展

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摘要 首先介绍国际合作DECOVALEX计划的概况和研究进展, 阐述中国参加该合作计划研究的必要性和重要意义。对国内外在岩石应力 - 水力 - 化学耦合过程方面的主要研究进展进行简略概述, 并重点总结了DECOVALEX计划 Task\_B及中国科学院武汉岩土力学研究所的研究课题组所取得的主要研究进展, 包括: (1) 开展了岩石应力 - 化学耦合条件下的单轴、三轴压缩试验、细观力学试验和CT扫描试验的系统研究和分析; (2) 建立了岩石破裂过程的弹塑性和应力 - 渗流耦合细胞自动机模型, 并用于对岩石声发射活动的Kaiser效应、II类曲线的形成机制以及孔隙水压力对岩石力学性质的影响规律和细观机制进行了模拟分析等。上述研究成果对于岩石应力 - 水力 - 化学耦合过程研究起到了积极的推进作用。

关键词 [岩石力学](#) [应力 - 水力 - 化学耦合过程](#) [细胞自动机](#) [DECOVALEX](#)

分类号

ADVANCES IN COUPLED MECHANICAL-HYDRO-CHEMICAL PROCESSES IN ROCKS

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Abstract

This paper firstly introduces the advance and development of international consortium of DECOVALEX (development of coupled thermo-hydro-mechanical (THM) models and their validation against experiments) project. A general summarization on the study of progress in mechanical-hydro-chemical coupling process in rocks is presented, followed by a detailed introduction to the progress of DECOVALEX Task\_B and Institute of Rock and Soil Mechanics, Chinese Academy of Sciences (CAS). Efforts of CAS are focused on uniaxial and triaxial compression tests, meso-mechanical tests and CT tests under the coupled stress-chemical condition. Based on the influences of chemical corrosion on mechanical and failure properties of rocks, the fracture criteria of multi-crack with chemical corrosion are proposed. Furthermore, a new numerical model named elastoplastic cellular automata for modeling rock failure process is set up by CAS, in which heterogeneity and flaws in rocks can be easily considered, and some typical behaviors of rocks such as Kaiser's effect and Class II curve are successfully modeled using elastoplastic cellular automata. Another cellular automata model for modeling coupled hydro-mechanical process for porous materials is also proposed, and the influence of water pressure on mechanical properties of rock and its meso-mechanism are analyzed using this model. The above-mentioned advance greatly promotes the research on mechanical-hydro-chemical coupling process in rocks.

Key words [rock mechanics](#) [mechanical-hydro-chemical coupling process](#) [cellular automata](#) [DECOVALEX](#)

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