

报告题目：多环境因素影响的岩石宏微观力学特性及本构行为演化研究

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摘要：针对岩石在高围压、温度及化学场共同作用下的力学行为演化过程尚不明晰的问题，本课题组对花岗岩、砂岩等常见岩石进行了一系列研究：（1）进行了岩石在高温、冻融和化学侵蚀环境模拟下的力学试验，揭示了岩石在耦合作用下力学特性的宏微观劣化机理，建立了考虑岩石压缩破坏全过程的损伤演化本构模型，基于离散元方法探究了岩石破坏过程中微裂纹的发育情况；（2）针对软岩隧道开挖过程中岩石的短期力学响应问题，获得了考虑膨胀应力、剪胀特性的弹塑性解析解，针对长期围岩力学响应问题，建立了分数粘塑性模型并推导了粘塑性区域位移的解析解。

Macro and Micro Mechanical Characteristics and Constitutive Behavior Evolution of Rocks Affected by Multiple Environmental Factors

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Abstract: Our research team conducted a series of investigations on rocks in order to fully understand the evolution process of rock mechanical characteristics under coupling effect of high confining pressure, temperature, and chemical erosion: (1) The rocks were treated with high temperature, freezing-thawing cycles and chemical erosion. The deterioration mechanisms of mechanical characteristics of rocks under coupling effect are explored. The damage evolution constitutive models considering the entire process of rock compression failure is established. Based on the discrete element method, the development of microcracks in the process of rock failure is investigated. (2) In order to describe the instantaneous mechanical response of rock during soft rock tunnel excavation, the elastic-plastic analytical solution considering swelling stress and dilatancy is obtained. In order to solve the corresponding problems of long-term surrounding rock mechanics, a novel fractional viscoplastic model is established, based on which the analytical solution of displacement in viscoplastic region is derived.