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论文

冻融循环对风化花岗岩物理特性影响的实验研究

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摘要：

在冻结温度为-40 ℃，融化温度20 ℃的环境下对风化花岗岩进行0，10，20，30次冻融循环实验；并对岩样进行室温下岩芯核磁共振和常规单轴压缩实验，得到冻融循环后岩石的孔隙度、孔隙分布和单轴抗压强度，孔隙度与循环次数拟合多项式。实验结果表明：冻融循环后风化花岗岩饱和水状态下的质量均会增加；岩石内部的孔隙分布发生了明显变化；中小尺寸的孔隙数量增加且随循环次数增加而增长；花岗岩强度明显降低，冻融系数和单轴抗压强度随循环次数的增加而减小，弹性模量有所降低。最后利用损伤力学原理对岩样进行冻融损伤分析，得到有效应力与孔隙度表达式，为研究寒区岩体工程损伤破坏机理和稳定性评价提供参考数据。

关键词： 风化花岗岩；冻融；核磁共振；单轴抗压试验；有效应力

Experimental study of freezing and thawing cycle influence on physical characteristics of weathered granite

Abstract:

Freezing and thawing experiments on weathered granite with the cycle index for 0，10，20，30 times were conducted，during which the freezing temperature was -40 ℃ and thawing temperature was 20 ℃.In order to get the porosity，pore distribution and uniaxial compression strength after freezing and thawing cycle，core nuclear magnetic resonance(NMR) experiment and conventional uniaxial compression experiment were adopted under room temperature.The results indicate that the quality of test pieces increase after freezing and thawing cycle，the inner pore distribution is changed，the amount of medium and small pore is increasing along with cycle times.In addition，freezing and thawing coefficient and uniaxial compression strength decrease with the increasing of cycle times.The freezing and thawing cycle not only lower the uniaxial compression strength，but also reduce elastic modulus of weathered granite sample.Finally，a damage analysis was conducted and the relationship between porosity and effective stress was obtained according to related damage mechanical theory.The experiment of measuring weathered rock mass’s physical characteristics in the condition of freezing and thawing cycle would provide reliable experimental data for the failure mechanism research of rock engineering in cold regions.

Keywords: weathered granite；freezing and thawing；nuclear magnetic resonance(NMR)；uniaxial compression experiment；effective stress

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