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高孔隙水压力作用下岩体软弱结构面(带)力学特性的试验研究

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EXPERIMENTAL RESEARCH ON MECHANICAL CHARACTERISTICS OF WEAK STRUCTURAL PLANE(ZONE) UNDER HIGH PORE WATER PRESSURE

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摘要 为研究岩体中的软弱结构面(带)在高应力与高孔隙水压力作用下的强度和变形特性，利用MTS815 Flex Test GT 岩石力学试验系统，对一大型水电工程的2个软弱结构面(带)进行水岩耦合三轴压缩试验。试验结果表明：软弱结构面(带)的强度参数f随孔隙水压力的升降变化甚微，c则随孔隙水压力升高迅速降低，在大于2 MPa的孔隙水压力下，c值可能完全丧失；软弱结构面(带)的抗剪强度随孔隙水压力升高逐渐减小，在10 MPa应力条件下，4 MPa孔隙水压力可使抗剪强度降低30%以上。软弱结构面(带)的变形性能随孔隙水压的升高急剧减弱，在10 MPa围压条件下，4 MPa孔隙水压力可使变形模量E降低达34.2%。研究成果表明，工程建设中，岩体中的软弱结构面(带)的力学特性参数取值不能忽视工程建成后的孔隙水压效应，对于一般工程，软弱结构面(带)强度参数的水压效应可采用有效应力原理进行预测，但对于高水头的重大工程，则应采用原样试验的方法加以确定。

关键词： 岩石力学 软弱结构面(带) 力学特性 水岩耦合 孔隙水压效应

Abstract： In order to study the strength and deformation characteristics of the weak structural plane(zone) with high stress and high pore water pressure，a series of triaxial tests coupling water and rock for two weak structural planes(zones) from a large hydraulic engineering are realized on MTS815 Flex Test GT rock mechanics test system. The results show that：the variation of the intensity parameter f of the weak structural planes (zones) is very little following the change of pore water pressure，while strength parameter c decreases rapidly with the increase of pore water pressure，and with a pore water pressure more than 2 MPa，c can disappear entirely；the shear strength of the weak structural plane(zone) lessen with the increase of pore water pressure，and the shear strength of the weak structural plane(zone) with 4 MPa pore water pressure will be reduced by more than 30% under 10 MPa normal stress. The deformation properties of the weak structural plane(zone) weakened dramatically when pore water pressure increases，and the deformation modulus E of the weak structural plane(zone) with 4 MPa pore water pressure reduces 34.2% under 10 MPa confining pressure. The research results show that：we should consider the influence of pore water pressure after the completion of the project when we select the value of the mechanical characters of weak structural plane(zone) in rock. For general engineering，the shear strength of weak structural plane(zone) can be forecasted with effective stress principle；for large engineering with high water head，we should make it with the undisturbed sample test.

Keywords： rock mechanics weak structural plane(zone) mechanical characteristics coupling water and rock effect of pore water pressure

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