

论文

岩体结构面蠕变损伤机理研究

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摘要:

通过对伯格斯模型和西原模型的分析比较,选取西原模型研究岩体结构面的蠕变损伤特性。在  $\tau_0 < \tau_s$  情况下,由西原模型推出剪切模量的表达式,以剪切模量为变量定义损伤变量,得到结构面的损伤变量表达式。并以泥岩剪切试验为例,计算了相同正压力作用下的结构面剪切模量和损伤量。结果表明:当  $\tau_0 < \tau_s$  时,剪切模量、损伤量均随时间趋于稳定,且结构面蠕变的前两个阶段损伤量较小,而当  $\tau_0 \geq \tau_s$  时,一段时间后,其损伤量开始突变;剪应力越大,其初始剪切模量越大,随时间降低越快,达到稳定蠕变阶段时降低量也相应越大;剪应力越大,结构面损伤量随时间增长越快,在达到稳定蠕变阶段时,损伤量也越大。

关键词: 岩体力学 蠕变损伤机理 剪切模量 结构面 西原模型 泥岩

MECHANISM OF CREEP DAMAGE ON STRUCTURE PLANE IN ROCK MASS

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Abstract:

At first, this paper compares the Burgers creep model with the Bingham-Kelvin creep model. Based on the comparison, the Bingham-Kelvin creep model is employed to study the creep damage characteristics of structural plane in rock mass. Under the condition that the shear stress applied on the plane is less than its shear strength ( i.e.,  $\tau_0 < \tau_s$  ), this paper derivates the expression of shear modulus with the Bingham-Kelvin model, and defines a damage variable taking the shear modulus as variable. Based on the shear tests on mudstone, this paper further calculates the shear modulus and damage value of the structural plane under the same normal compressive stress. The results show that: (1) When  $\tau_0 < \tau_s$ , the shear modulus and damage value of the structural plane vary little as the time goes, and the damage value of the structural plane is little at the first two phases, and (2) when  $\tau_0 \geq \tau_s$ , the damage value alters suddenly some time later. The initial shear modulus increases with the increasing in the shear stress, and under higher shear stress, they reduce more quickly with time and decrease more while creep reaches to the stable phase. The creep deformation of structural plane increases with the increasing in shear stress and time, [JP3]and the damage increases more under higher shear stress when creep attains to the stable phase. [JP]

Key words: Rock mechanics, Creep damage, Shear modulus, Structural plane, Bingham-Kelvin creep model, Mudstone

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