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水作用下砂岩断裂力学效应试验研究

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EXPERIMENTAL RESEARCH ON FRACTURE MECHANICAL EFFECT OF SANDSTONE UNDER WATER CORROSION

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摘要 消落带是库岸边坡稳定的敏感地带，在库水位反复升降作用下，岩石的断裂韧度变化规律对库岸边坡的稳定性十分关键。以三峡库区典型库岸边坡砂岩为研究对象，针对库岸边坡消落带的实际赋存环境，设计长期浸泡和浸泡－风干循环作用2种试验方案。试验结果表明：(1) 长期浸泡和浸泡－风干循环作用下砂岩试样有明显“变软”的趋势，其断裂韧度、抗拉强度和抗压强度劣化趋势基本一致，劣化幅度在试验初期较为明显，后期逐渐趋于平缓；(2) 各力学参数劣化的幅度差别较大，其中，断裂韧度劣化最快，抗拉强度次之，抗压强度劣化相对较慢；(3) 比较而言，在浸泡－风干循环作用下，砂岩的各力学参数劣化趋势更加明显，说明在模拟库岸边坡消落带水－岩作用时，浸泡－风干循环作用是不可忽略的因素。研究成果对大量存在的库岸边坡稳定性分析具有重要参考价值，同时，相关试验方法也可以为类似试验提供参考。

关键词： 岩石力学；浸泡&ndash 风干循环；断裂韧度；抗拉强度；相关性

Abstract： As hydro-fluctuation belt is the sensitive area of bank slopes，the change law of fracture toughness under the fluctuation of reservoir water level is crucial to the bank slope stability. According to the actual occurrence environment of hydro-fluctuation belt，taking typical sandstone in the Three Gorges Reservoir area as the research object，long-term soaking and immersion-air dry circulation test schemes are designed. The test results show that：(1) Sandstone samples have obvious softening trend under long-term soaking and immersion-air dry circulation. The degradation trends of fracture toughness，tensile strength and compressive strength of sandstone are consistent basically；and the degradation rate is relatively obvious in initial stage，later gentle. (2) The degradation trends of parameters are quite different. And the fracture toughness is the fastest，tensile strength is the second，and compressive strength is relatively slow. (3) Comparing the two schemes，the degradation trends of mechanical parameters of sandstone show more apparent under immersion-air dry circulation，which shows that the action of immersion-air dry cycle can not be ignored in simulating the hydro-fluctuation belt′ s water-rock interaction. The research results have important reference value for analyzing the stability of bank slopes exist in reservoir area，and relevant test methods can also provide reference for similar tests.

Keywords： rock mechanics immersion-air dry cycle fracture toughness tensile strength correlation