

不同加载条件下岩石材料破裂过程的声发射特性研究

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Acoustic emission characteristics in failure process of rock under different uniaxial compressive loads

摘要

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摘要 在刚性压力机上对岩石进行单轴全过程加载和加卸载试验, 测试岩石材料在不同加载条件下受力变形过程的应力-应变、应力-时间-声发射事件累计值、应力-时间-声发射事件率关系曲线。在试验结果的基础上, 分析了加载时岩石全过程声发射特性、加卸载时岩石在卸载和重复加载时的声发射特性。试验表明: 在不同的应力水平进行人为卸载时在卸载过程中岩石都会产生明显的声发射; 在应力水平低于峰值强度的50%时卸载后的重复加载过程中, 在未达到前次加载应力水平之前时岩样的声发射事件数很少(事件率很小)或不产生声发射, 即出现典型的Kaiser效应现象; 而在超过60%峰值强度的应力水平卸载后的重复加载过程中则出现明显的声发射现象, 即出现所谓的Felicity现象; 在加载和加卸载试验中, 岩石峰后破坏过程中都产生大量的声发射事件。试验还表明, 对于具有中压突增型声发射特性的岩样, 都有峰值前出现声发射相对平静期现象的特点。

关键词: 岩石声发射 加卸载 相对平静期 Kaiser效应 Felicity现象

Abstract: Experiments on acoustic emission (AE) characteristics of full-regime rock failure are carried out with stiffness test machine (MTS) under uniaxial loading, cyclic loading-unloading conditions to obtain the relations of stress-strain, stress-time-accumulative counts of AE, stress-time-AE rates. Based on the test results, the AE characteristics of loading process, unloading and reloading of loading-unloading process are analyzed. The results show that AE phenomena can apparently appear during the process of unloading. When being reloaded under the stress level not more than 50% of the peak stress, there are less or little AE counts occurring as long as the stress level is not more than the previous loading stress level, that means the Kaiser effect occurs. While reloading is made again on the stress-level of over 60% of the peak stress, there occurs obviously AE events, that is so-called the Felicity phenomenon. Rock samples show a large amount of AE events in the post-peak region for both loading and loading-unloading processes. And the results also show that there exists a relatively tranquil period phenomenon of AE for all samples of the style of AE abruptly increasing during middle stress stage.

Keywords: acoustic emission of rock loading-unloading relatively tranquil period Kaiser effect Felicity phenomenon

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