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直接拉伸、劈裂及单轴压缩试验下岩石的声发射特性

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摘要 采用自行研制的岩石直接拉伸试验装置, 对砂岩和石灰岩2种岩样进行直接拉伸、劈裂及单轴压缩试验。试验结果表明, 2种岩石的声发射活动情况大体相同。在单轴压缩条件下, 加载早期的声发射活动较为活跃, 随着荷载的增加, 许多试样的声发射率较加载初期有所下降, 这通常被认为与试样中的裂隙压密有关。劈裂试验条件下岩样的声发射活动规律与单轴压缩条件下基本一致, 所不同的是: 在劈裂试验条件下, 声发射活动在整个加载过程中持续不断, 直至临近破坏时, 声发射活动大量增加, 即劈裂试验条件下未观察到与单轴压缩试验类似的“裂隙压密”阶段声发射率较高的现象, 也未观察到压缩试验中试样发生微破裂时, 声发射累计事件数出现阶跃、变形曲线上出现拐点的现象。在直接拉伸条件下, 试样的声发射活动又有很大不同, 在破坏发生前的整个加载过程中, 观察到的声发射事件数和能率远少于单轴压缩和劈裂试验的结果。对于大多数试样, 声发射事件仅在试样破坏时才能观察到。

关键词 [岩石力学; 声发射; 直接拉伸; 劈裂试验; 单轴压缩; 破坏](#)

分类号

ACOUSTIC EMISSION OF ROCKS UNDER DIRECT TENSION, BRAZILIAN AND UNIAXIAL COMPRESSION

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Abstract

Direct tension, Brazilian and uniaxial compressive tests were carried out with sandstone and limestone samples collected from mines of China, with a testing apparatus of direct tension developed by the authors. The results show that the acoustic emission(AE) detected from the two rock samples is similar. During the loading process of compressive tests, the observed AE event numbers at the beginning of loading are usually quite high; and then decrease to a lower level with the raising of loading, which is believed to be produced by closing of the micro cracks in the rocks. In Brazilian tests, the behaviour of AE is similar to that in compression, i.e. AE events appeared early in the loading stage and kept approximately the same level during the total loading process until sample's failure where AE events reaches its maximum value. However, the phenomenon that AE events show

higher values at initial loading stage as those in compression does not observe in Brazilian tests. Moreover, in compression, a sudden large increase in AE cumulative events can usually be observed when a small crack appeared before sample's failure; while such a result is not obtained in Brazilian test. In the direct tension tests, the observed AE is completely different, and both the numbers of AE events and energy during the loading process before failure are much lower than those of the other tests. Moreover, AE under direct tension could hardly be detected until the failure of the samples. In fact, for most samples, AE events under direct tension are detected only when the peak loading stress is reached.

Key words [rock mechanics](#); [acoustic emission\(AE\)](#); [direct tension](#); [Brazilian test](#); [uniaxial compression](#); [failure](#)

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