

二长花岗岩三轴压缩下声发射特征围压效应的试验研究

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EXPERIMENTAL STUDY OF CONFINING PRESSURE EFFECT ON ACOUSTIC EMISSION CHARACTERISTICS OF MONZONITE GRANITE UNDER TRIAXIAL COMPRESSION

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摘要

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摘要 岩石材料在受载情况下, 发生变形和内部破裂, 储存的部分能量以应力波的形式释放出来, 产生声发射现象。采用三轴压缩试验和声发射试验, 研究玲珑金矿二长花岗岩声发射特征与力学参数之间的关系。结果表明: (1) 岩石试样在三轴试验条件下, 其声发射特征基本符合岩石加载破坏过程中的4个阶段, 其中压实阶段在围压对岩石材料的压实作用下没有明显体现出来。(2) 通过分析围压对岩石记忆效应的影响得出, 在相对低围压水平时, Kaiser效应显著性会随轴向应力水平提高而降低, Felicity效应显著增大; 随着围压水平的提高, Kaiser效应显著增大, Felicity效应显著降低。(3) 在声发射法测量地应力过程中采用三轴试验更为适合, 三轴试验可消除应力环境不同和高应力水平Kaiser效应模糊所引起的误差, 使测量值更接近实际岩体所处的应力状态。(4) 随着围压水平的提高, 岩石的抗压强度随之提高, 岩石破裂前夕声发射特征参数呈现突发性特征, 表现为突然激发出高能量振铃计数率、能量累积迅猛增加, 并且伴随没有峰后曲线的岩石突然破裂现象。

关键词: [岩石力学](#) [三轴压缩试验](#) [声发射](#) [围压](#) [Kaiser效应](#) [岩石破裂](#)

Abstract: When rock material is loaded, the deformation and internal fracture will be induced, and then part of the stored energy will be released in the form of stress wave, which triggers the acoustic emission(AE) phenomenon. Based on triaxial compression tests and AE test, the relationship between AE characteristics and mechanical parameters of the monzonite granite taken from Linglong gold mine is investigated. The main conclusions can be drawn as follows: (1) When rock sample is under triaxial compression, the AE characteristics basically conforms to the four stage of rock failure process, however, the compaction stage (closure of microcracks) is not shown clearly due to the compaction effect of confining pressure on the tested rock material. (2) By analyzing the influence of confining pressure on the memory effect of rock material, it is indicated that, under relatively low confining pressure, the Kaiser effect distinctiveness decreases with the increase of axial stress level while the Felicity effect distinctiveness shows a contrary result. However, with increasing confining pressure, the Kaiser effect distinctiveness becomes increasing and the Felicity effect distinctiveness decreases. (3) It is more suitable to employ triaxial compression tests for in-situ stress measurement with AE, because triaxial compression tests can eliminate the error induced by different stress environments and indistinctions of Kaiser effect under high confining pressure level, which makes the measured value more close to real stress state of rock mass. (4) With the increase of the confining pressure level, the compressive strength of rock increases correspondingly. Moreover, the AE characteristics on the eve of rock fracture show sudden feature, which is represented by sudden excitation of high-energy ring rate, rapid increase of energy accumulation and sudden rock fracture without post-peak curve.

Keywords: [rock mechanics](#) [triaxial compression tests](#) [acoustic emission\(AE\)](#) [confining pressure](#) [Kaiser effect](#) [rock fracture](#)

Received 2012-01-12:

引用本文:

纪洪广, 张月征, 金 延, 孔灵锐.二长花岗岩三轴压缩下声发射特征围压效应的试验研究[J] 岩石力学与工程学报, 2012,V31(6): 1162-1168

JI Hongguang, ZHANG Yuezheng, JIN Yan, KONG Lingrui.EXPERIMENTAL STUDY OF CONFINING PRESSURE EFFECT ON ACOUSTIC EMISSION CHARACTERISTICS OF MONZONITE GRANITE UNDER TRIAXIAL COMPRESSION[J] , 2012,V31(6): 1162-1168

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