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北山深部花岗岩不同应力状态下声发射特征研究

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STUDY OF ACOUSTIC EMISSION CHARACTERISTICS OF BEISHAN DEEP GRANITE UNDER DIFFERENT STRESS CONDITIONS

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摘要 采用MTS815 Flex Test GT岩石力学试验系统及声发射(AE)三维定位实时监测系统，开展北山深部花岗岩不同应力条件下岩石破坏的声发射特征研究。试验得到北山花岗岩的直接拉伸强度为9.53 MPa，仅为其单轴平均抗压强度的1/17。试验结果表明，在拉伸应力条件下，由于无原生微裂隙闭合过程，声发射事件出现时间较晚并集中出现于破坏阶段；峰值应力后，声发射信号的继续增加说明花岗岩并未立刻破断，而仍具有一定拉伸承载能力。在压缩应力条件下，初期加载阶段即有声发射信号出现并随加载应力增加而持续增长，反映原生裂纹闭合及新生裂纹扩展演化的过程；随着围压增加，花岗岩在峰值应力阶段延性变形特征显著增强，其内部裂隙(损伤)在该阶段渐进式发展，导致声发射事件的集聚量远高于其他阶段；同时，围压增加使北山花岗岩的非线性特征增强，特别是破坏前的显著延性变形特征与其他工程常见花岗岩特性具有明显不同。研究得到北山花岗岩在不同应力状态下的变形特征和声发射特征，为北山花岗岩在不同应力条件下损伤演化机制研究奠定基础。

关键词： 岩石力学 北山花岗岩 微裂隙扩展 声发射

Abstract： The foundational mechanical behavior and acoustic emission(AE) characteristics of intact Beishan granite under different stress conditions are investigated，with the MTS815 Flex Text GT rock mechanics test system and PCI－II AE test system. The obtained direct tensile strength is 9.53 MPa，which is 1/17 of the average uniaxial compressive strength. Under the tensile stress condition，the AE events appear much later and mainly concentrate at the failure stage，since there is not a closing process of original microcracks. At the post-peak strength，the constantly increasing AE events indicate that the granite specimen does not break immediately and still has a certain tensile strength. Under compressive stress condition，AE events appear at initial loading stage，and increase continuously with loading stress，representing the initiation and propagation of the stress-induced microcracks. With the increase of confining pressure，the granite exhibits a more significant ductile at the peak stress，and a nonlinear mechanical behavior at the same time，with a progressive propagation of the microcracks(damage)，which leads to more intensive accumulated AE events. The significant ductile characteristics especially before the failure stage are obviously different from those of other common granite. The achievements of the work about mechanical behavior and AE characteristics of intact Beishan granite under different stress conditions are essential to the further study on the damage evolution mechanism of Beishan granite under different stress conditions.

Keywords： rock mechanics Beishan granite microcrack propagation acoustic emission(AE)

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