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# 高应力岩石围压卸载后动力扰动的临界破坏特性

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# CRITICAL FAILURE CHARACTERISTICS OF HIGH STRESS ROCK INDUCED BY IMPACT DISTURBANCE UNDER CONFINING PRESSURE UNLOADING

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摘要 利用改造的动静组合分离式霍普金森压杆(SHPB)加载装置，系统研究砂岩历经三维加载－围压卸载－轴向冲击的临界破坏特性。试验结果表明：砂岩受外界冲击时的临界破坏特性受轴向静压影响明显，冲击强度随着轴向静压的增加出现先增加后减小的趋势；当无轴压和轴向静压为单轴抗压强度的20%时，应力－应变曲线为典型的I型曲线；随着轴向静压的增大，应力－应变曲线逐渐转变为II型曲线。试样破坏过程中能量变化逐渐由吸收扰动能量转变为释放弹性储能，该现象可以较好地反映岩爆发生过程中高静应力和动力扰动的相互作用机制，为深部岩爆机制的深入研究提供试验支持。另外，利用数字散斑相关计算方法对试样应力加载过程进行表面位移场监测；结果表明，常规冲击加载下，试样表现出为整体膨胀特性，当轴向静压为72 MPa时，则表现为入射端张剪性破坏和膨胀性破坏的共同作用，反映出轴向静载对试样动态破裂面断裂方式的影响。

关键词： 岩石力学 动静组合加载 分离式霍普金森压杆(SHPB) 动态强度 高速摄像机 数字散斑相关方法

Abstract： The critical failure characteristics of sandstone experiencing change stresses from three-dimensional loading to confining stress unloading and to axial impact，are investigated by the improved split Hopkinson pressure bar(SHPB) with axial static pressure and confining pressure. The results show that：(1) The critical failure characteristics of sandstone under external impact is influenced obviously by axial static pressure；and the impact strength first increases and then decreases as the axial static pressure increases. (2) The stress-strain curve of sample under coupled static and dynamic loading is a typical class I curve when without axial static pressure and the axial static pressure is 20% of uniaxial compressive strength. (3) With the increase of axial static pressure，the stress-strain curve changes to the typical class II curve gradually. In the failure process of sample，the energy change law is from disturbed energy absorption to elastic stored energy release，which can reflect the mechanism of interactions between high static stress and dynamic disturbance in the process of rockburst. The results can provide a test support for the further research of rockburst mechanism. The surface displacement field is monitored by digital speckle correlation method(DSCM). The surface displacement field results show that the samples present whole expansion characteristics under conventional impact loading；but under the axial static pressure of 72 MPa，the samples present the interaction of tension-shear failure and expansion failure，which reflects the effect of axial static pressure on the fracture mode of dynamic failure surface of sample.

Keywords： rock mechanics coupled static and dynamic loading split Hopkinson pressure bar(SHPB) dynamic strength high speed video camera digital speckle correlation method(DSCM)



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