

论文

煤岩组合结构失稳滑动过程的实验研究

姜耀东, 王涛, 宋义敏, 王欣, 张伟

- 1. 中国矿业大学(北京) 煤炭资源与安全开采国家重点实验室, 北京 100083;
- 2. 中国矿业大学(北京) 力学与建筑工程学院, 北京 100083

摘要:

为了研究结构失稳型冲击地压机理, 依据双面剪切实验模型设计了砂岩-煤组合试样在不同轴向荷载下的滑动摩擦实验, 运用数字相机和声发射记录仪搭建了声光监测系统, 克服以往煤岩摩擦实验不易进行位移观测的难题。实验研究了煤岩组合样本失稳滑动的产生条件、特定条件下的滑动类型、位移演化规律以及滑动过程所伴随的声发射特征。实验发现: 组合结构的滑动形式与轴向荷载具有相关性, 轴向荷载越大, 越易于出现失稳滑动; 失稳滑动前无明显的位移征兆, 失稳滑动后, 滑动位移快速增长; 产生滑动时的剪切应力峰值与轴向荷载呈正相关性, 而失稳滑动产生的位移量与轴向荷载无相关性, 本次实验一次失稳滑动产生的最大滑动位移为35.5 μm, 最小为5.6 μm; 试件滑动前有较为密集的声发射事件出现, 稳定滑动后, 声发射数降低。实验模拟了结构失稳型冲击地压的发生过程, 并对于认识断层活化, 以及煤体克服顶底板夹持作用突然滑出的物理过程具有重要意义。

关键词: 煤岩; 结构失稳; 声发射; 冲击地压; 数字散斑

Experimental study on the stick-slip process of coal-rock composite samples

Abstract:

On the basis of double-sided shear experimental model, sliding friction experiments under different axial loads to the combination of sandstone-coal samples were done by using digital cameras and acoustic emission recorder to build a sound and light monitoring system, and overcome the problem that the displacement was not easy to be observed in previous coal rock friction experiments. The experiment studied the unstable sliding production condition of the combination of coal and rock samples, the sliding type under certain conditions, displacement evolution law as well as the acoustic emission law accompanied by sliding process. The experiment shows that the sliding form of composite structures are relevant to the axial load, the greater the axial load is, the unstable sliding is more likely to appear; no obvious signs of displacement appear before unstable sliding and the sliding displacement grow rapidly after unstable sliding; the peak value of shear stress is positively correlated to axial load while sliding, and the displacement generated by unstable sliding has no correlation with axial stress. The maximum unstable sliding displacement of the test was 35.5 μm, and the minimum value was 5.6 μm; there are intensive acoustic emission events before the specimen sliding, after sliding becoming stable, acoustic emission counts decreased. The experiment simulated the occurrence process of structural instability of rock burst, and it is of great significance for understanding the fault activation, as well as the physical process that the coal overcomes the roof and floor clamping action and sudden sliding off.

Keywords: coal; stick-slip; acoustic emission; rock burst; digital speckle

收稿日期 2012-03-14 修回日期 2012-06-21 网络版发布日期 2013-03-05

DOI:

基金项目:

国家重点基础研究发展规划(973)资助项目(2010CB226801); 国家自然科学基金资助项目(51174213); 新世纪优秀人才项目(NCET-10-775)

通讯作者: 姜耀东

作者简介: 姜耀东(1958—), 男, 江苏海安人, 教授, 博士生导师, 博士

作者Email: jiangyd@cumtb.edu.cn

扩展功能

本文信息

- Supporting info
- PDF(2110KB)
- [HTML全文]
- 参考文献PDF
- 参考文献

服务与反馈

- 把本文推荐给朋友
- 加入我的书架
- 加入引用管理器
- 引用本文
- Email Alert
- 文章反馈
- 浏览反馈信息

本文关键词相关文章

煤岩; 结构失稳; 声发射; 冲击地压; 数字散斑

本文作者相关文章

- 姜耀东
- 宋义敏
- 王涛
- 王欣
- 张伟

PubMed

- Article by Jiang,Y.D
- Article by Song,X.M
- Article by Yu,s
- Article by Yu,x
- Article by Zhang,w

参考文献:

本刊中的类似文章

---

Copyright by 煤炭学报