煤炭学报 2013, 38(01) 85-90 DOI: ISSN: 0253-9993 CN: 11-2190

论文

基于Hoek-Brown准则的深部煤层钻井坍塌压力弹塑性分析

张立松，闫相祯，杨秀娟，田中兰，杨恒林

中国石油大学（华东） 储运与建筑工程学院，山东 青岛 266580

摘要：

利用三轴压缩实验确定了沁水盆地平定区块深部煤岩在高围压条件下的弹塑性特征。以Hoek-Brown准则为极限平衡条件，提出了基于工程允许塑性区半径的深部煤层井眼坍塌压力弹塑性计算方法，得到控制深部煤层井壁坍塌的主要参数：煤岩地质强度指标GSI值、非均匀地应力系数及工程允许塑性区半径。以平定区块PD-095井为例，分析了深部煤层坍塌压力弹塑性结果与弹性结果的差别，讨论了坍塌压力弹塑性结果随影响因素的变化规律。结果表明，当工程允许塑性区半径为井眼半径的1.5倍时，PD-095井坍塌压力弹塑性结果较Hoek-Brown准则、Mohr-Coulomb准则弹性结果分别降低6.52%，4.66%；随着工程允许塑性区半径的增大、地应力非均匀性的降低，井眼坍塌压力下降；坍塌压力与地质强度指标GSI值呈负乘幂函数关系。

关键词： Hoek-Brown准则；深部煤层；坍塌压力；弹塑性；塑性区半径

Elasto-plastic analysis of collapse pressure for deep coal seam drilling based on Hoek-Brown criterion

Abstract:

Elasto-plastic characteristics of deep coal seam at Pingding region in Qinshui Basin was determined under the effect of high confining pressure using triaxial compression test.Taking Hoek-Brown criterion as the limit equilibrium condition，elasto-plastic calculation method of collapse pressure for deep coal seam was derived based on plastic zone radius，and influence factors which control wellbore collapse were obtained，including Geologic Strength Index(GSI)，non-uniform stress coefficient and engineering allowable plastic zone radius.Taking CBM well PD-095 in Pingding region as an example，the elasto-plastic results of collapse pressure were compared with elastic results，and the relationship between collapse pressure and influence factors was analyzed.The results show that the elasto-plastic results of collapse pressure decrease 6.52%，4.66% than the elastic results of Hoek-Brown criterion and Mohr-Coulomb criterion when the plastic zone radius is 1.5 times of wellbore radius；the elasto-plastic results of collapse pressure decrease with the increment of plastic zone radius and the descendent of the stress non-uniform；minus power function relationship between the collapse pressure and the GSI value is presented.

Keywords: Hoek-Brown criterion；deep coal seam；collapse pressure；elasto-plastic analysis；plastic zone radius

收稿日期 2011-12-22 修回日期 2012-07-31 网络版发布日期 2013-02-21

DOI:

基金项目:

国家重点基础研究发展计划（973）资助项目(2010CB226706)；国家科技重大专项资助项目(2011ZX05036-001)；中央高校基本科研业务费专项资金资助项目(11CX04050A)

通讯作者: 张立松

作者简介: 张立松(1982—)，男，山东临朐人，讲师，博士

作者Email: lisongzhang1982@163.com

参考文献：

本刊中的类似文章