

不同法向应力下含瓦斯煤剪切破坏细观演化过程研究

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MESO-EVOLUTION PROCESS OF GAS-CONTAINING COAL SHEAR FAILURE UNDER DIFFERENT NORMAL STRESSES

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摘要

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摘要 利用自主研发的煤岩细观剪切加载试验装置,开展压剪载荷作用条件下法向应力分别为0, 2和4 MPa时含瓦斯煤的细观裂纹开裂、扩展及其宏观破坏演化过程的研究。结果表明:剪应力达到峰值前,含瓦斯煤样表面会有明显裂纹出现,达到峰值后剪应力都有一个急剧下降的过程,该过程与Charge-coupled device(CCD)摄像机观测下的主裂纹贯通相对应,但煤样没有立刻剪断,仍有一定的承载能力,随后剪应力随时间缓慢下降;在剪切过程中,煤样上部均出现破碎带,并伴随煤块的脱落,同时法向应力越小,煤样破坏越严重,裂纹发育越明显;含瓦斯原煤的开裂点均出现在煤样的上部与下部,受原煤原始裂纹和节理等因素影响,主裂纹扩展方向并不与剪切方向重合,而是沿剪切方向曲折向前发展。

关键词: 岩石力学 含瓦斯煤 法向应力 细观裂纹 剪切试验

Abstract: Using self-developed microscopic shear testing device for coal rock, the evolution process of shear microcracking, expansion and macroscopic failure of gas-containing coal was studied at normal stresses of 0, 2 and 4 MPa under compression-shear load condition. The results show that cracks appear apparently before the peak shear stress, and the shear stress has a apparent sharp decline process after the peak shear stress. This process corresponds to the main crack coalescence, which is observed by charge-coupled device(CCD) camera. However, shear failure does not happen immediately and the coal still has a certain bearing capacity. Subsequently, the shear stress decreases slowly with the time. Accompanied by the shedding of coal, the fractured zone appears in the upper part of the coal in the process of shearing. Simultaneously, the smaller the normal stress is, the more serious the damage of the coal is. In that case, more obvious cracks appear. The cracking tips appear in the upper and lower parts of raw coal. The cracking tips appear in the upper and lower parts of raw coal. Because of the effect of original cracks in the raw coal, the main crack direction moves tortuously forward along the shear direction, but dose not coincide with shear spreading direction.

Keywords: rock mechanics gas-containing coal normal stress meso-crack shear test

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