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0.9 m薄煤层SH型槽波频散特征及波形模式

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摘要 在0.9 m薄煤层中使用放炮方法做微震震源的条件，通过对所采集到的薄煤层槽波信号进行分析，发现薄煤层槽波在频域中存在高频和低频两个独立并且不连续的波段.其中高频区大约以2000 Hz为中心，低频域的中心频率约为490 Hz，并且高频域和低频域的能量差异不显著.通过时频分析，可以清晰地看到高、低两个频域几乎在同一时刻触发，并且其小波相关系数在这两个域中的分布规律表现出一定的相似性.通过对0.9 m薄煤层槽波频散曲线的理论分析可知，现场观测到的Airy震相的频率及速度和其理论值较为接近.震源置于煤层中心，且炸药能量对顶底板的扰动，对第二阶对称波形模式下槽波高频部分的形成起着关键作用.在这一对称高阶波形模式下槽波的波速基本上和煤层顶底板中S波的波速一致.由于这两个触发的波形模式在时间域中具有相似的特征，建议在高频域和低频域同时发育较好的薄煤层槽波勘探中，可以采用在同一时间域中高低频相结合的方法提高利用槽波勘探分析的效果.

关键词 薄煤层 SH型槽波 能谱 频散 时频分析 波形模式

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Dispersion characteristics and wave shape mode of SH channel wave in a 0.9m-thin coal seam

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Abstract According to analysis results of channel waves recorded in a 0.9m-thin coal seam when using blasting as seismic source, the result of energy spectrum shows two major frequency bands in those channel waves. One is centered at 2000 Hz, and the other is at 490 Hz. Furthermore, the two frequency bands are not continuous and the difference of peak values is not obvious between these two bands. It is apparent that these two frequency bands are triggered at the same time in the time frequency distribution graphics of channels wave, moreover, the distribution of wavelet coefficients in these two frequency bands is similar to some degree. This is totally different from channel waves that were recorded in a 2.1m-thick coal seam. The Airy phase frequency and speed observed in the testing field is about 550 Hz and 824.5 m/s, respectively, which are close to theoretical ones of Airy phase with 0.9m thickness. Because seismic boreholes were deployed in the middle of coal seam, the energy of dynamite would be distributed symmetrically on the face of coal seam. It would be very important for generating the symmetrical wave shape mode. Similarly, since the thickness of coal seam is only 0.9 meters, the energy of dynamite would be enough to vibrate the roof and floor by the seismic source. The vibration plays a key role for generating the second higher wave mode of channel wave. Therefore, the speed of channel wave is close to the speed of S wave in rocks, which is positive to identify the speed of S wave in rocks from channel waves recorded in thin coal seams. Furthermore, the analysis method of combining low with high frequency region would be recommended to reinforce the effectiveness of detecting by channel waves.

Key words Thin coal seam; SH channel wave; Energy spectrum; Dispersion; Time frequency analysis; Wave shape mode

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