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压裂诱发的微地震震源机制及信号传播特性

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Focal mechanism of micro-seismic induced by hydrofracture and its signal propagation characteristics

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摘要 随着仪器、处理和解释技术的进步,微地震在描绘储层内的压裂和断裂系统方面的应用愈来愈广,在储层管理上发挥了越来越大的作用.本文分析了压裂产生的脆性变形以及微地震产生机制,探讨了裂隙动态变化及产生的微地震响应特性,分析了利用微地震数据研究裂隙时空分布规律的可能性.主要内容包括:裂纹的产生诱发微地震,在水力压裂过程中裂纹尖端效应和漏泄效应是产生微地震的主要原因;微地震震源矩张量采用特征值分解法可以分解为双力偶成分、补偿线性矢量极偶成分和各向同性成分;通过有限差分正演模拟分析了微地震信号的传播特性,微地震源特性和速度模型会显著影响微地震波形.

关键词: 微地震 破裂机制 震源机制解 矩张量 裂隙演化

Abstract: With the progress of seismic instruments, processing and interpretation techniques, micro seismic plays a more and more important role in describing fracture systems in reservoir management. In this paper we discuss brittle deformation mechanism, micro seismic generation mechanism, fracture dynamic changes, and micro seismic response characteristics, and analyze the possibility to study the fracture time and space distribution rule using micro seismic data. The following observations are obtained: A. Cracks can induce micro seismic, crack tip effects and leakage effects are the main reasons of micro seismic in the process of hydraulic fracturing; B. Micro seismic moment tensor can be decomposed by the eigenvalue decomposition method as DC, CLVD and ISO part; C. Through finite difference forward modeling we can investigate micro seismic signal propagation characteristics. Micro seismic source and velocity model may affect micro seismic waveform characteristics.

Keywords: micro seismic fracture mechanism focal mechanism solution moment tensor crack evolution

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