

论文

鄂尔多斯盆地东南缘地应力、储层压力及其耦合关系

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摘要:

采用水压致裂测量地应力方法, 获得了鄂尔多斯盆地东南缘26口煤层气井地应力分布, 通过统计分析, 建立了二叠系山西组2煤储层地应力与煤层埋藏深度之间的相关关系和模型, 揭示了现今地应力分布规律及受控机制。研究表明, 本区二叠系山西组2煤层破裂压力梯度、闭合压力梯度和煤储层压力梯度的平均值分别为 1.96, 1.69, 0.71 MPa/100 m。煤储层最大水平主应力、最小水平主应力和垂直主应力以及储层压力均随着煤层埋藏深度增大呈线性规律增高。在 1 000 m 以浅煤储层地应力状态主要表现为 $\sigma_v > \sigma_{hmax} > \sigma_{hmin}$, 最小水平主应力小于16 MPa, 现今地应力处于拉伸应力状态, 煤储层有效应力系数 K_0 为0.48, 且低于油气盆地页岩层中的有效应力系数值($K_0 = 0.80$); 在1 000 m以深煤储层地应力状态转化为 $\sigma_{hmax} \geq \sigma_v \geq \sigma_{hmin}$, 最小水平主应力大于16 MPa, 现今地应力转化为挤压应力状态。本区现今地应力受华北区域构造应力场控制, 最大水平主应力方向主要以NEE-SWW方向为特征。本区煤储层压力偏低, 相同深度条件下鄂尔多斯盆地东南缘煤储层压力要比沁水盆地南部偏低0.73~0.93 MPa, 且煤储层压力与地应力呈正相关关系, 随着地应力的增加, 煤储层压力增大。

关键词: 鄂尔多斯盆地东南缘; 地应力; 煤储层压力; 耦合关系

In-situ stress and coal reservoir pressure in Southeast margin of Ordos basin and their coupling relations

Abstract:

Adopted hydraulic fracturing method to measure in-situ stress, obtained in-situ stress of 26 coalbed methane wells in Southeast margin of Ordos Basin. Through statistical analysis, the correlations and their models between in-situ stress of No.2 coal seam in Shanxi Formation of Permian and the burial depth of coal seam were established, the distribution law of present stress and its controlled mechanism were revealed. The results show that the average value of the fracture pressure gradients, closure pressure gradients and coalbed reservoir pressure gradients of the No.2 coal seam in Shanxi Formation of Permian in study area are 1.96, 1.69, 0.71 MPa/100 m, respectively. Coalbed reservoir stress (the maximum horizontal principal stress, the minimum horizontal principal stress, the vertical principal stress) and the coalbed reservoir pressure both increases linearly with the increasing of the burial depth. The coalbed reservoirs with a burial depth lower than 1 000 m, in-situ stress state principally shows $\sigma_v > \sigma_{hmax} > \sigma_{hmin}$, the minimum horizontal principal stress is below 16 MPa, the recent in-situ stress state is tension; the coal reservoir effective stress coefficient equals to 0.48, lower than the parameter of shales in oil gas basin, which is 0.80 generally. In-situ stress state of coalbed reservoirs with a burial depth deeper than 1 000 m transforms into $\sigma_{hmax} \geq \sigma_v \geq \sigma_{hmin}$, the minimum horizontal principal stress is bigger than 16 MPa, the in-situ stress state transforms into compression. The present in-situ stress is controlled by the regional tectonic stress field of North China, the maximum horizontal principal stress direction is mainly in the NEE-SWW direction. The coal reservoir pressure in the study area is lower, coal reservoir pressure under the conditions of the same depth in southeast margin of Erdos basin is lower 0.73-0.93 MPa than southern Qinshui basin. Coal reservoir stress has positive correlation to the recent stress. As stress increases, the coal reservoir stress increases.

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