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有效应力对煤层气解吸渗流影响试验研究

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摘要 以阜新高瓦斯矿井孙家湾矿为例, 将煤样放入自制的三轴瓦斯解吸渗透仪中, 通过先加载后卸载、连续进行煤层气解吸渗流试验, 模拟煤层气在复杂地应力条件下的赋存和运移开采过程, 得到有效应力与煤层气解吸和渗流特性间的关系, 并拟合了其关系表达式, 揭示一些新的相互作用规律: (1) 解吸量、解吸时间与有效应力变化规律均呈负指数递减关系, 与卸载方式无关; (2) 有效应力存在一临界点, 当小于此值时, 解吸量和解吸时间随有效应力增加而迅速提高, 而当有效应力大于此值时, 两者随之增加幅度不大, 对于孙家湾2#煤样分界点所对应有效应力为3.0 MPa左右; (3) 存在一临界有效应力值(类似于临界解吸压力), 有效应力大于此临界值则解吸量极少或几乎没有, 解吸时间趋于0, 而孙家湾2#煤样临界有效应力值为10.0 MPa左右; (4) 在加载过程中, 有效应力与渗透率、渗透系数关系曲线呈正指数减小, 这表明煤体在较小的有效应力范围内、孔隙压力不断增加的加载过程中, 吸附作用是影响渗透率和渗透系数的主控因素; (5) 卸载过程中, 有效应力与渗透率和渗透系数呈抛物线关系, 这从试验角度证明了煤层气开采中三阶段主导作用的存在, 即有效应力主导作用阶段、基质收缩效应主导作用阶段和滑脱效应主导作用阶段。

关键词 [采矿工程](#) [三维应力](#) [煤层气](#) [解吸渗流](#) [有效应力](#)

分类号

EXPERIMENTAL STUDY ON EFFECT OF EFFECTIVE STRESS ON DESORPTION AND SEEPAGE OF COALBED METHANE

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Abstract

Based on the typical high gassy mine, taking Sunjiawan Mine in Fuxin for example, the experiment of desorption and seepage of coalbed methane(CBM) was performed continuously through first loading and last unloading after the sample was placed into the home-made triaxial osmoscope. The exploration and transportation processes of CBM were simulated under the condition of the complicated stresses. The relationships among effective stress, desorption character, and seepage character were presented. The relationship expressions were studied. Some novel interaction laws were obtained as follows: (1) the variation laws among desorption quality, desorption time and effective stress all have negative exponential decrement relationship, and the relationship is not correlated with the loading method. (2) a cut-off point in the effective stress exists, and the desorption quality and time will increase rapidly with the increase of effective stress when it is smaller than the cut-off point value. On the contrary, the increase extent will become smaller. For the Sun sample No.2, the cut-off point value is about 3.0 MPa. (3) a critical effective stress(such as critical desorption pressure) is found. The desorption quantity and time will be approached to zero when the effective stress is larger than the critical value. The critical value is about 10.0 MPa for Sun sample No.2. (4) in the loading processes, the relationship curves among effective stress, permeability and permeability coefficient show positive exponential decrement. This above indicates that the adsorption of CBM is the main control factor for the scope of smaller effective stress in the process of pore pressure increase. (5) in the unloading process, the relationship curves among effective stress, permeability and permeability coefficient are found with parabolic shapes. This demonstrates the existence of three main phases in the exploration of CBM in the experimental view: they are effective stress, matrix shrinkage and slippage effects.

Key words [mining engineering](#) [three-dimensional stresses](#) [coalbed methane](#) [desorption and seepage](#) [effective stress](#)

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