

论文

高温作用下围压对页岩力学特性影响的试验研究

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摘要:

利用MTS815型程控伺服刚性试验机对页岩开展高温常规三轴压缩试验, 基于试验结果分析围压与页岩应力-应变曲线特征、峰值强度、弹性模量、泊松比、峰值应变的关系。结果表明, 按体积应变特征, 应力-应变曲线可归为3类: 扩张型、压缩-扩张过渡型和压缩型, 围压对页岩具有较明显的扩容作用。在同一温度时, 在5~25 MPa围压范围内, 页岩峰值强度($\sigma_1-\sigma_3$)较低, 表现出较强的塑性变形破坏特征, 峰值强度和弹性模量具有随围压增加而增大的趋势。围压小于15 MPa时, 页岩泊松比随围压增大而增大, 而峰值轴向应变和峰值横向应变均随围压增加而逐渐降低; 围压大于15 MPa后, 泊松比随围压增加呈小幅下降, 峰值轴向应变和峰值横向应变随围压增加而略有增大。

关键词: 围压; 页岩; 力学性质; 高温常规三轴压缩试验; 体积应变

Experimental study on influence of confining pressure on shale mechanical properties under high temperature condition

Abstract:

High temperature conventional triaxial compression test of shale were carried out by using the MTS815 servo-controlled testing machine, based on the results of the tests, the relationships between confining pressure and the characteristic of shale stress-strain curve, peak strength, elastic modulus, Poisson's ratio, peak strain were investigated, and the general regulation is obvious. According to the characteristics of volumetric strain, the stress-strain curves were classified into three types. They are dilatation type, compression-dilatation type, compression type, and the confining pressure has conspicuous dilatation effect on shale. At the same temperature, when confining pressure rises from 5 MPa to 25 MPa, shale peak strength ($\sigma_1-\sigma_3$) is comparatively lower, indicating stronger plastic deformation, and peak strength and elastic modulus increase with uprising confining pressure. When confining pressure is lower than 15 MPa, shale Poisson's ratio increases with increasing confining pressure while peak axial strain and peak circle strain decreases with increasing confining pressure. When confining pressure is higher than 15 MPa, shale Poisson's ratio decreases slightly with the increasing confining pressure, while peak axial strain and peak circle strain increase slightly with the increasing confining pressure.

Keywords: confining pressure; shale; mechanical properties; high temperature conventional triaxial compression test; volumetric strain

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