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论文

纳米材料稳定的微泡沫钻井液降低煤层气储层伤害的实验研究

蔡记华，袁野，王济君，李鑫杰，曹伟建

中国地质大学（武汉） 工程学院，湖北 武汉 430074

摘要：

针对我国煤层气储层低孔低压的特点，笔者提出采用纳米材料暂堵技术与可循环微泡沫钻井液相结合的技术思路。通过泡沫钻井液稳定性评价、钻井液性能参数测试与微观形态观测、煤岩膨胀性测试、煤岩滚动回收率评价、原状煤岩气体渗透率测试等方法，对纳米材料稳定的微泡沫钻井液降低煤层气储层伤害的能力进行了评价。结果表明：纳米材料可以提高泡沫钻井液的稳定性；纳米材料稳定的微泡沫钻井液密度（0.7~1.0 g/cm 3）与黏度指标可控，并且能有效抑制煤岩基质吸水膨胀，可满足低孔低压煤层的钻进要求；纳米材料稳定的微泡沫钻井液可有效封堵低孔低渗煤层，而通过表层切片处理后，煤岩气体渗透率恢复率达72%~96%。综合来看，纳米材料稳定的微泡沫钻井液不仅可以保证煤层稳定，还能降低对煤储层的伤害，适合低孔低压煤层气储层钻进。

关键词： 纳米材料；微泡沫钻井液；煤层气；储层伤害；低孔低压煤层

Experimental research on decreasing coalbed methane formation damage using micro-foam mud stabilized by nanoparticles

Abstract:

For the low porosity and pressure coalbed methane(CBM)reservoirs in China，the paper adopted the technology thought of combining the temporally plugging technology of the nanomaterials with circulative micro foam drilling fluid.Through the methods of evaluation on the stability of foam drilling fluid，performance tests of drilling fluid and microstructure observation，the expansibility，rolling recovery rate and gas permeability test of original coal rock，the ability of micro-foam mud stabilized by nanoparticles on reducing the damage of CBM reservoir was evaluated.We found that firstly，nanoparticles can improve the stability of foam drilling fluids.Furthermore，the micro-foam mud stabilized by nanoparticles have the advantage of high-controllable density(0.7-1.0 g/cm 3)and viscosity，which can adapt to the drilling requirements of the low porosity and pressure coal seam，and which can effectively restrain the adsorption and swelling of coal rock matrix.Finally，the micro-foam mud stabilized by nanoparticles can effectively plug the low porosity and permeability coal seam，while the gas permeability recovery rate of coal is as high as 72%-96% after slice processing for the surface of pollution section of coal rock.With the integrative consideration，the micro-foam mud stabilized by nanoparticles can not only protect coal seam stability，but reduce the reservoir damage of coalbed methane，and is suitable for the low porosity and low pressure coalbed methane reservoirs drilling.

Keywords: nanoparticles；micro-foam drilling fluids；coalbed methane；reservoir damage；low porosity and low pressure coal seam

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通讯作者：蔡记华