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石油学报 » 2015, Vol. 36 » Issue (s1): 97-108 DOI: 10.7623/syxb2015S1012

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## 煤层气井排采液面-套压协同管控——以沁水盆地樊庄区块为例

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### Cooperative control of working fluid level and casing pressure for coalbed methane production: a case study of Fanzhuang block in Q inshui Basin

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摘要

图/表

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全文: PDF (5839 KB) HTML (1 KB)

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#### 摘要

以樊庄区块煤层气开发直井排采管控为研究实例,以排采工程数据为主要依据,探讨各排采控制阶段流体流动形态与煤储层伤害机制,揭示排采液面-套压协同控制过程,并基于煤层气井排采曲线分析和高产气井排采参数统计,获得排采液面-套压协同控制指标。研究结果表明,樊庄区块煤层气井需经历“以液为主-气、液混合-以气为主”的排采控制过程以及排水降液面阶段、憋压阶段、产气量上升阶段、稳产阶段和产气量衰减阶段5个排采控制阶段,其中,排水降液面阶段、憋压阶段、产气量上升阶段是流体流动形态转变和储层伤害的易发阶段,也是排采管控的关键阶段。排水降液面阶段以日产水量为控制参数,以井底流压为评判指标,采取缓慢、长期的排采原则;憋压阶段以日产水量和套压为控制参数,以憋压、稳定动液面的方式实施管控;产气量上升阶段采取适当憋压、提升动液面的控制原则,保持套压高于0.2 MPa,控制日产水量缓慢降至0.2~0.5 m<sup>3</sup>,使动液面深度回升至煤层中部以上10~50 m;稳产阶段需适当憋压,稳定动液面在煤层以上,并维持排采作业稳定;产气量衰减阶段尽量避免较大幅度的排采制度调整,使产气量、产水量平稳下降。

**关键词:** 煤层气井, 排采, 动液面, 套压, 协同管控, 樊庄区块

#### Abstract:

Taking production control for coalbed methane (CBM) straight wells in Fanzhuang block as an example, fluid flow patterns and coal reservoir damage mechanism in different production control stages are studied mainly based on production data, then cooperative control process of working fluid level and casing pressure is revealed, and cooperative control indexes are obtained based on analysis of production curves of CBM wells and statistical data of production parameters of high production CBM wells. Results show that production of CBM wells in Fanzhuang block experiences production control process of "water first, gas and water together, gas first" and five production control stages such as drainage and liquid level falling stage, keeping casing pressure stage, gas production rising stage, stable production stage and gas production falling stage. First three stages are the important phases for fluid flow pattern transformation and reservoir damage, and also are the key phases for production control. In drainage and liquid level falling stage, taking daily water production as control parameter and flowing bottomhole pressure as evaluation index, and the production process in this stage should be slow and long term. In keeping casing pressure stage, taking daily water production and casing pressure as control parameters, the production control means are keeping casing pressure and stabilizing working fluid level. The production principle in gas production rising stage is properly keeping casing pressure and rising working fluid level, casing pressure should be larger than 0.2 MPa, daily water production should be dropped slowly to 0.2~0.5 m<sup>3</sup>/d, leading working fluid level rise above 10~50 m of the middle of coal seam. In stable production stage, casing pressure should be properly kept, working fluid level should be high than coal seam, and production should be stabilized. In gas production falling stage, large adjustment of production system should be avoided and gas and water production should be declined steadily.

**Key words:** CBM well production working fluid level casing pressure cooperative control Fanzhuang block

收稿日期: 2015-04-25

中图分类号: TE349

#### 基金资助:

国家自然科学基金项目(No.41330638, No.41402135, No.41272154)、国家重大科技专项(2011ZX05061)和中国石油天然气股份有限公司重大科技专项(2013E-2205)资助。

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#### 引用本文:

刘世奇, 赵贤正, 桑树勋, 杨延辉, 李梦溪, 胡秋嘉, 杨艳磊. 煤层气井排采液面-套压协同管控——以沁水盆地樊庄区块为例[J]. 石油学报, 2015, 36(s1): 97-108.

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电话：62067137(收稿查询)，010-62067128(期刊发行、地质勘探栏目编辑)，62067139(油田开发、石油工程栏目编辑)

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syxb8@cnpc.com.cn(石油工程栏目编辑)，syxb4@cnpc.com.cn(期刊发行)

本系统由北京玛格泰克科技发展有限公司设计开发 技术支持：support@magtech.com.cn

京ICP备13000890号-1