

## 第 72 期：近年来应用 CMG 软件模拟非常规储层开发的 SPE 文章汇总

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最近几年，美国二叠纪盆地非常规油气成功开发，作为最主流的非规模拟产品，CMG 软件广泛应用于储量评估、产能预测、优化井距和裂缝参数优化；以及渗析、压裂液返排、支撑剂分布、天然裂缝闭合效果、注气提高采收率等数值模拟研究。据不完全统计，近年来应用 CMG 软件模拟非常规储层开发的 SPE 文章有 90 篇，汇总如下表。

序号	SPE 编号	中文篇名	英文篇名
1	SPE-178697-MS	页岩压裂和废水回注诱发地震的预测评价	A Critical Evaluation of Simple Predictive Models Relating Fluid Injection to Induced Seismicity from Shale Hydraulic Fracturing and Wastewater Injection
2	SPE-175029-MS	利用耦合地质力学模型分析页岩储层的压降敏感性	Analysis of Drawdown Sensitivity in Shale Reservoirs Using Coupled-Geomechanics Models
3	SPE-166201-MS	应用地质力学耦合油藏模拟技术进行页岩储层裂缝注入测试设计和解释	Geomechanics Coupled Reservoir Flow Simulation For Diagnostic Fracture Injection Test Design And Interpretation In Shale Reservoirs
4	SPE-2014-1922538	蒙大拿州埃尔姆古力油田注气提高采收率研究：EOS 模拟与油藏模拟	EOS Modeling and Reservoir Simulation Study of Bakken Gas Injection Improved Oil Recovery in the Elm Coulee Field, Montana
5	SPE-174549-PA	页岩气藏高含气量新型岩心分析方法	Novel Analytical Core-Sample Analysis Indicates Higher Gas Content in Shale-Gas Reservoirs
6	SPE-170892-MS	含水 CO <sub>2</sub> 对裂缝导流性页岩的成岩作用	Diagenetic Influence of Aqueous CO <sub>2</sub> on Fracture Conductivity of Shaly Rocks

7	SPE-176714-MS	水平井多级压裂数值模拟及其在致密页岩储层中的应用	Multi-Stage Fractured Horizontal Well Numerical Simulation and Its Application in Tight Shale Reservoirs
8	SPE-171664-PA	水力压裂页岩气储层综合表征技术及开采历史拟合研究	Integrated Characterization of Hydraulically Fractured Shale-Gas Reservoirs & Production History Matching
9	SPE-162186-MS	巴肯地层水力压裂设计及其效果分析	Hydraulic Fracturing Design and Its Effects on Oil Recovery in Bakken Formation
10	SPE-137728-MS	萨斯喀彻温省巴肯组二氧化碳驱油潜力评估	Assessment of CO <sub>2</sub> Flooding Potential for Bakken Formation, Saskatchewan
11	ISOPE-I-15-812	页岩气生产关键参数确定及人工裂缝设计	Determination of Key Parameters and Hydraulic Fracture Design for Shale Gas Productions
12	SPE-177285-MS	页岩储层纳米尺度孔隙约束对评估页岩气资源和凝析特征的影响	Impact of Nanoscale Pore Confinement on Estimation of Gas Resources and Gas/Condensate Behavior in Shale Reservoirs
13	SPE-177283-MS	注气吞吐提高页岩储层凝析液开发潜力评价	Evaluation of Enhanced Condensate Recovery Potential in Shale Plays by Huff-n-Puff Gas Injection
14	SPE-141434-MS	巴肯油藏酸化研究	Understanding the Souring at Bakken Oil Reservoirs
15	SPE-165315-MS	鹰滩页岩油气藏生产递减与数值模拟对比分析	Production Decline and Numerical Simulation Model Analysis of the Eagle Ford Shale Play
16	SPE-167220-MS	多尺度孔渗页岩气藏数值模拟	Multi-Porosity Multi-Permeability Models for Shale Gas Reservoirs
17	SPE-178577-MS	纳米孔隙对富液页岩油藏油气比及开采机理的影响数值模拟研究	Numerical Study of Impact of Nano-Pores on Gas-Oil Ratio and Production Mechanisms in Liquid-Rich Shale Oil Reservoirs
18	SPE-178579-MS	流体、岩石和人工裂缝性质对富液态烃页岩油藏储层开采效果的影响	Impact of Fluid, Rock and Hydraulic Fracture Properties on Reservoir Performance in Liquid-Rich Shale Oil Reservoirs
19	SPE-175137-MS	富液页岩油藏开采机理及油气比特性数值模拟研究	Numerical Study of Production Mechanisms and Gas-Oil Ratio Behavior of Liquid-Rich Shale Oil Reservoirs

20	SPE-175994-MS	非常规富液页岩挥发油藏生产机理的数值模拟研究	Numerical Study of Production Mechanisms in Unconventional Liquid-Rich Shale Volatile Oil Reservoirs
21	SPE-175913-MS	富液页岩(LRS)凝析气藏产量递减数值模拟研究	Modeling Production Decline in Liquid Rich Shale (LRS) Gas Condensate Reservoirs
22	SPE-175529-MS	富液页岩储层及完井参数随机研究	Stochastic Study of Reservoir and Completion Parameters in Liquid Rich Shale
23	SPE-175531-MS	井距对多相流富液页岩储层产能的影响: 模拟研究	Effect of Well Spacing On Productivity Of Liquid Rich Shale (LRS) Reservoirs With Multiphase Flow: A Simulation Study
24	SPE-178639-MS	基于数值模拟技术的页岩油气井返排管理	Modelling Based Recommendation for Choke Management in Shale Wells
25	SPE-153535-MS	含气页岩储层多孔隙度运移模拟研究	Modeling Multiple-Porosity Transport in Gas-Bearing Shale Formations
26	SPE-144401-MS	页岩气模拟器设计和检验要求: 与现有模拟器对比	Design and Examination of Requirements for a Rigorous Shale-Gas Reservoir Simulator Compared to Current Shale-Gas Simulator
27	SPE-167217-MS	致密油层二氧化碳吞吐开发效果评价	Performance Evaluation of CO <sub>2</sub> Huff-n-Puff Processes in Tight Oil Formations
28	SPE-162549-MS	致密油层二氧化碳驱油方案优化	Optimization of CO <sub>2</sub> Flooding Schemes for Unlocking Resources from Tight Oil Formations
29	SPE-175131-MS	富油页岩油藏缝缝注气数值模拟	Simulation of Fracture-to-Fracture Gas Injection in an Oil-Rich Shale
30	SPE-169012-MS	Barnett 页岩气藏注入 CO <sub>2</sub> 提高气藏采收率敏感性研究	A Sensitivity Study of Potential CO <sub>2</sub> Injection for Enhanced Gas Recovery in Barnett Shale Reservoirs
31	SPE-178747-STU	应用复杂缝网模拟页岩储层气体运移综合模型	A Comprehensive Model for Simulation of Gas Transport in Shale Formation with Complex Hydraulic Fracture Geometry
32	SPE-169575-MS	巴肯致密油藏 CO <sub>2</sub> 吞吐数值模拟研究	Simulation Study of CO <sub>2</sub> Huff-n-Puff Process in Bakken Tight Oil Reservoirs

33	ARMA-2015-520	致密油储层注入 CO <sub>2</sub> 提高油气采收率和地质封存的数值模拟研究	Numerical Simulation Study on Injection for Enhancing Hydrocarbon Recovery and CO <sub>2</sub> Sequestration in Tight Oil Formations
34	SPE-164538-MS	马塞勒斯页岩气藏多组分气体流动和凝析模拟	Simulation of Multicomponent Gas Flow and Condensation in Marcellus Shale Reservoir
35	SPE-178582-MS	验证低渗透油藏压力和渗透率新型有效评估方法	Validation of a New and Cost Effective Technique to Estimate Reservoir Pressure and Permeability in Low-Permeability Reservoirs
36	SPE-177299-MS	应力相关渗透率对页岩气藏开发效果影响评价	Evaluation Of The Effect Of Stress dependent Permeability On Production Performance in Shale Gas Reservoirs
37	SPE-171799-MS	渗析机理对返排特征的影响：数值模拟研究	Impact of Imbibition Mechanism on Flowback Behavior: A Numerical Study
38	SPE 1922172-MS	多级压裂流动模拟，优化页岩储层开采	Flow Modeling in Multi-Stage Hydraulic Fracturing Patterns to Optimize Shale Reservoir Production
39	SPE-154652-MS	致密砂岩气藏钻井液(水基 vs 油基)相捕集伤害影响	Effect of Drilling Fluid (Water-Based vs Oil-Based) on Phase Trap Damage in Tight Sand Gas Reservoirs
40	SPE-164521-MS	应力各向异性对非常规气藏产能的影响	Effect of Stress Anisotropy on Well Productivity in Unconventional Gas Reservoirs
41	SPE-154648-MS	致密气藏水基钻井液和油基钻井液的固相伤害	Phase trapping damage in use of water-based and oil-based drilling fluids in tight gas reservoirs
42	SPE-163590-MS	低渗透高压实水驱油藏数值模拟	Numerical Modeling of a Low-Permeability, Highly Compactible Waterflooded Reservoir
43	SPE-144057-MS	双重孔隙度油藏水平井压裂模拟-用于致密气、页岩气和致密油藏	Modeling Fractured Horizontal Wells As Dual Porosity Composite Reservoirs - Application To Tight Gas, Shale Gas And Tight Oil Cases
44	IPTC-11278-MS	天然裂缝性气藏递减曲线分析：“拟时”与“物质平衡拟时”适用性研究	Decline Curve Analysis for Naturally Fractured Gas Reservoirs: A Study on the Applicability of "Pseudo-time" and "Material Balance Pseudo-time"
45	SPE-175938-MS	在压力与渗透率相关的油藏中，压降管理可以提高产能，是这样吗？	Draw-Down Management Leads to Better Productivity in Reservoirs with Pressure-Dependent Permeability - or Does It?

46	SPE-178507-MS	鹰滩实例研究：考虑富有机质非常规油气藏孔隙度分布可使油气藏增产 25%	The Consideration of Pore Size Distribution in Organic-Rich Unconventional Formations May Increase Oil Production and Reserve by 25%, Eagle Ford Case Study
47	SPE-168992-MS	通过井距研究，开发米德兰盆地致密油层	Well-spacing Study to Develop Stacked Tight Oil Pay in Midland Basin
48	SPE-178018-MS	致密气藏伤害机理评价：珀斯盆地矿场实例	Evaluation of Damage Mechanisms in Tight Gas Reservoirs: Field Example from Perth Basin
49	SPE-175433-MS	致密气藏损伤机理的评价：实验室实验和现场数据与数值模拟的结合	Evaluation Of Damage Mechanisms In Tight Gas Reservoirs: Integration Of Laboratory Experiments And Field Data With Numerical Simulation
50	SPE-169564-MS	利用页岩容积概念估算 SRV，以及应用微地震和生产动态数据对其进行验证：Marcellus 在 Haynesville 应用	Estimation of Stimulated Reservoir Volume Using the Concept of Shale Capacity and its Validation with Microseismic and Well Performance: Application to the Marcellus and Haynesville
51	SPE-167778-MS	利用页岩容积概念估算 SRV，以及应用微地震和生产动态数据对其进行验证	Estimation of Stimulated Reservoir Volume Using the Concept of Shale Capacity and Its Validation With Microseismic and Well Performance
52	SPE-176850-MS	致密气藏泥浆滤液侵入对底层压力测量和油水界面确定的影响	Effect of Mud Filtrate Invasion on Measurement of Formation Pressure and Determination of Gas-Water Contact Depth in Tight Gas Reservoirs
53	SPE-162645-MS	数值模拟软件在页岩储层表征中的实际应用	Practical Use of Simulators for Characterization of Shale Reservoirs
54	SPE-147596-MS	体积压裂页岩油藏开发效果	Shale Oil Production Performance from a Stimulated Reservoir Volume
55	SPE-178440-PA	致密油藏非平面人工裂缝模拟生产的半解析模型	A Semianalytical Model for Production Simulation From Nonplanar Hydraulic-Fracture Geometry in Tight Oil Reservoirs
56	SPE-169511-MS	压裂区域和未压裂区域裂缝导流能力以及单口页岩油井压裂液返排模拟	Proper Inclusion of Hydraulic Fracture and Unpropped Zone Conductivity and Fracturing Fluid Flowback in Single Shale Oil Well Simulation
57	SPE-175990-MS	强非均质性致密油藏高精度渗透率模型建立	High-Resolution Permeability Modeling in Highly Heterogeneous Tight-Oil Reservoirs

58	SPE-167761-MS	油藏压裂模拟：致密油藏人工裂缝形态的影响	Fractured Reservoir Modeling: Effects of Hydraulic Fracture Geometries in Tight Oil Reservoirs
59	SPE-167761-PA	水力压裂致密油藏裂缝形态对油井开采效果的影响	Effect of Fracture Geometry on Well Production in Hydraulic-Fractured Tight Oil Reservoirs
60	SPE-175531-MS	井距对多相流富液页岩储层产能的影响：一个数值模拟研究	Effect of Well Spacing On Productivity Of Liquid Rich Shale (LRS) Reservoirs With Multiphase Flow: A Simulation Study
61	SPE-162663-MS	根据驱替实验同时评估致密地层相对渗透率和毛管压力	Simultaneous Estimation of Relative Permeability and Capillary Pressure for Tight Formations from Displacement Experiments
62	ARMA-2013-555	地质力学对页岩气藏开发效果影响模拟研究	Numerical Evaluation of the Impact of Geomechanics on Well Performance in Shale Gas Reservoirs
63	SPE-165377-MS	非常规气藏气体解吸和地质力学影响模拟	Simulation of Gas Desorption and Geomechanics Effects for Unconventional Gas Reservoirs
64	SPE-167137-MS	Barnett 页岩水平井重复压裂选井及时机确定	Selection of Candidate Horizontal Wells and Determination of the Optimal Time of Refracturing in Barnett Shale (Johnson County)
65	SPE 1922945-MS	页岩气藏开采半解析模型的建立	Development of a Semi-Analytical Model for Simulation of Gas Production in Shale Gas Reservoirs
66	SPE-167225-MS	页岩气藏支撑剂分布对气井开发效果影响的数值模拟研究	Simulation of Proppant Distribution Effect on Well Performance in Shale Gas Reservoirs
67	SPE-171010-MS	天然裂缝闭合对非常规气藏产量的长期影响	Long Term Effect of Natural Fractures Closure on Gas Production from Unconventional Reservoirs
68	SPE-164509-MS	非常规气藏多段压裂水平井优化	Optimization of Multiple Hydraulically Fractured Horizontal Wells in Unconventional Gas Reservoirs
69	SPE-165343-MS	非常规气藏生产的设计和优化方法	An Efficient Reservoir Simulation Approach to Design and Optimize Unconventional Gas Production
70	SPE-132524-PA	通过井底压力和注入剖面历史拟合来估算注	Estimates of Fracture Lengths in an Injection Well by History Matching

		入井的裂缝长度	Bottomhole Pressures and Injection Profile
71	SPE-1922108-MS	巴肯致密油藏井距优化研究	Optimization of Well Spacing for Bakken Tight Oil Reservoirs
72	SPE-178973-MS	水力压裂井与 Fracpack 完井返排管理策略	Choke Management Strategies for Hydraulically Fractured Wells and FracPack Completions in Vertical Wells
73	SPE-189785-MS	非常规富液储层混相注气提高采收率适用参数研究	A Parametric Study on the Applicability of Miscible Gases Based EOR Techniques in Unconventional Liquids Rich Reservoirs
74	SPE-189788-MS	致密油藏混注氮气和二氧化碳提高采收率：分压降低和竞争性吸附的综合机理	Enhanced Recovery by Injection of Nitrogen and Carbon Dioxide Mixtures in Tight Reservoirs : A Combination of Partial Pressure Reduction and Competitive Adsorption
75	SPE-189795-MS	适用全耦合混合人工裂缝（HHF）模型进行 Horn River 页岩储层三维地质力学模拟：渗透率演化及衰减过程	3D Geomechanical Modeling in the Complex Fracture Network of the Horn River Shale Using a Fully-Coupled Hybrid Hydraulic Fracture HHF Model: Permeability Evolution and Depletion
76	SPE-189801-MS	加密井水力压裂过程中压力降低对诱发应变的影响：降低裂缝击中和压力干扰的关键	Pressure Depletion's Impact on Induced Strain During Hydraulic Fracturing in Child Wells: The Key to Mitigate Fracture Hits and Pressure Interference
77	SPE-189779-MS	在地质和经济参数不确定的情况下，巴肯地区提高采收率过程的可行性分析	Viability of EOR Processes in the Bakken Under Geological and Economic Uncertainty
78	SPE-189803-MS	用核磁共振法估算致密地层中残余水饱和度	On Estimating Irreducible Water Saturation in Tight Formations Using Nuclear Magnetic Resonance Relaxometry
79	SPE-189810-MS	利用常用的地面钻井和压裂数据进行裂缝的实时完井优化	Real-Time Completion Optimization of Fracture Treatment Using Commonly Available Surface Drilling and Fracing Data
80	SPE-189804-MS	非常规油藏天然气吞吐提高 EOR 过程中气体注入深度研究	Investigation of Gas Penetration Depth During Gas Huff-N-Puff EOR Process in Unconventional Oil Reservoirs
81	SPE-189804-MS	页岩凝析油藏注气提高采收率实验与数值模拟研究	Experimental and Numerical Study of Enhanced Condensate Recovery by Gas Injection in Shale Gas-Condensate Reservoirs

82	SPE-185181-PA	采用实验设计、响应面方法和蒙特卡罗算法对致密油储层进行历史拟合工作流程	An Iterative Work Flow for History Matching by Use of Design of Experiment, Response-Surface Methodology, and Markov Chain Monte Carlo Algorithm Applied to Tight Oil Reservoirs
83	SPE-177001-PA	煤层气系统液相吸附和解吸机理：一个老问题的新见解	Mechanism of Liquid-Phase Adsorption and Desorption in Coalbed Methane Systems: A New Insight into an Old Problem
84	SPE-183645-PA	页岩凝析油藏注气提高采收率实验与数值模拟研究	Experimental and Numerical Study of Enhanced Condensate Recovery by Gas Injection in Shale Gas-Condensate Reservoirs
85	SPE-178747-PA	复杂人工裂缝形态的页岩储层中气体运移综合模拟模型	A Comprehensive Model for Simulation of Gas Transport in Shale Formation With Complex Hydraulic-Fracture Geometry
86	SPE-178619-PA	页岩凝析油藏流动单元	Flow Units in Shale Condensate Reservoirs
87	SPE-178618-PA	耦合多相流和地质力学对水力压裂返排过程中失水影响的数值模拟研究	Numerical Investigation of Coupling Multiphase Flow and Geomechanical Effects on Water Loss During Hydraulic-Fracturing Flowback Operation
88	SPE-171626-PA	控制鹰滩页岩流体运移和分布的因素	Factors Controlling Fluid Migration and Distribution in the Eagle Ford Shale
89	SPE-189454-PA	部分支撑裂缝闭合的地质力学模拟及其对返排和产气的意义	Geomechanical Simulation of Partially Propped Fracture Closure and Its Implication for Water Flowback and Gas Production
90	SPE-174287-PA	基于测井和硬度的测量数据，Horn River 页岩岩心天然裂缝和力学性质研究	Natural Fractures and Mechanical Properties in a Horn River Shale Core From Well Logs and Hardness Measurements