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      23.6 × 10^4 t;

            19.7 × 10^4 t   657 ×

17% 。   370 ×

                          (10^4 t   10^4 t

)   10^4 t   43.7% 。

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      (、   )   SEC

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    2008

          683 t/d   619 t/d

                  349 × 10^4 t

317 × 10^4 t   9.2% 。   。

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                                    2   .   . DZ/T 0217—2005
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8%   15.3%   140.5 ×   3   .
10^4 t   79.6 × 10^4 t   43.3% 。   M .   :   1998.
                                    4   .   J .
                                        2007 28(3) : 309 – 314.
                                    5   .
          、   J .   2010 17(1) : 51 – 53.
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                  1 381.16 × 10^4 t   J .   2008 15(2) : 31 – 33.
    9   1   7   .
                                        J .   2009 30(2) : 223 – 229.
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                          、   2006 13(4) : 28 – 30.
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              3 a 。   2008   J .   2009 16(2) : 96 – 98.
                  1 a;   10   .   J .
                                        2009 16(1) : 100 – 102.

19(2):81−83.

Abstract:Inadequate natural energy and poor transmission of pressure will give rise to deep pressure decline after putting into development in low permeable reservoir. Pressure decline will induce damages to rock physical properties and flowing character, i. e. reservoir rock presents stress sensitivity. Simulating changing process of reservoir pressure by flowing test, threshold pressure gradients at different effective overburden pressures are tested, and relationship between threshold pressure gradients and effective overburden pressures is studied. With mercury−injection test, nuclear magnetic resonance spectrometry analysis and rock mechanics test, changing mechanism for threshold pressure gradients in changing process of reservoir pressure is thoroughly analyzed. It was understood that, the threshold pressure gradients increases with reservoir pressure declines, i. e. threshold pressure gradients is sensitive to stress. It is also indicated that the lower the rock permeability, the bigger the increasing amplitude of threshold pressure gradients, which means that the stress sensitivity is stronger. It is suggested that, when calculating rational spacing between wells, it is necessary to consider the effect of reservoir pressure maintenance level on threshold pressure gradients.
Key words:low permeability; threshold pressure gradient; stress sensitivity; net overlying pressure; pore throat
Liu Li,Geoscience Research Institute,Shengli Oilfield Company,SINOPEC,Dongying City,Shandong Province, 257015, China

Zhang Xing,Yang Shenglai, Zhang Ling et al. Experimental study on factors of KlinKenberg permeability in low permeable gas reservoir. *PGRE*, 2012,19(2):84−86.

Abstract:CNPC found a low−permeability gas reservoir with CO_2 in Jilin oil fields. Because the rock properties and fluid properties are unique, it is not accurate to analysis the effects of gas slippage effect on KlinKenberg permeability and penetration capacity. In view of this specificity, they are determined and analyzed by single−phase gas flow laboratory experiments. Experimental studies show that the KlinKenberg effect is found in the gas flow process in core and the influence factors are important including the core type, confining pressure, gas type and temperature. The KlinKenberg permeability of porosity core is higher than that of micro−fracture core. With the increasing of confining pressure, the slop of permeability−mean pressure curve is not changed, but the KlinKenberg permeability and its amplitude are decreased. Because of the different molecular weights, the KlinKenberg permeability of carbon dioxide (big molecular weight) is higher than that of natural gas and nitrogen gas (small molecular weight). The influence of temperature on gas flow at low temperature is greater than that at high temperature, that is, the KlinKenberg permeability of 20 ℃ is higher than that of 50, 80 and 140 ℃.
Key words:low−permeability gas reservoir; KlinKenberg permeability; gas slippage effect; influence factor; KlinKenberg effect
Zhang Xing, MOE Key Laboratory of Petroleum Engineering,China University of Petroleum(Beijing),Beijing City,102249,China

Li Lianjiang. Study on drainage gas pattern for offshore gas wells,Chengdao oilfield. *PGRE*, 2012,19(2):87−89.

Abstract:After the condensate gas wells have been flooded, the choice of drainage gas recovery plan must be considered with the specific production environmental restrictions. In the paper, according to different stages conditions of the liquid production and gas production in a condensate gas well, the approximate drainage gas process pattern for offshore gas wells is studied by the wellbore temperature and pressure drop models. And, an effective feasible and economic drainage gas technology, the electric pump drainage gas recovery scheme, is put forward. Through the implementation of drainage gas recovery scheme, the natural gas output of the well is improved. The drainage gas schemes adopted by the gas well at different production stage can also be referenced for other gas wells nearby.
Key words:condensate gas wells; pressure drop model' temperature drop model; water−out gas production technique; Chengdao oilfield
Li Lianjiang,Offshore Oil Production Plant, shengli Oilfield Company, SINOPEC, Dongying City, Shandong Province, 257237, China

Zhuang Li, Zhang Ling. Growth trend study of proved oil and gas reserves based on the upgrade rate of probable reserves. *PGRE*, 2012,19(2):90−92.

Abstract:Oil and gas reserves growth trend prediction research is the key factor for the oil company to make exploration and development strategy. From the study of contribution of probable reserves to the increased proved reserves of one oil company for ten years, it shows a steady rate at about 50% in the last three years. Upgrade rate of probable reserves can be classified into yearly increased and accumulative probable reserves upgrade rate. Research shows that the accumulative probable reserves upgrade rate has more significant meaning for the prediction of the growth of incased proven reserves next year. Considering the quality of increased probable reserves is very close in the recent years, based on the relationship of increased proved reserves with the accumulative probable reserves, a formula is summarized for the prediction of increased proved reserves, with convincing results tested with actual data. This method can be used by the exploration and development decision−making departments.
Key words:controlled reserve;proved reserve;contribution of controlled reserve;upgrading of controlled reserve;reserve prediction
Zhuang Li,Research Institute of Petroleum Exploration and Development, SINOPEC, Beijing City, 100083, China

Wang Shuhua, Wei Ping. SEC reserves dynamic evaluation and analysis. *PGRE*, 2012,119(2):93−94.

Abstract:Since Sinopec's public offering in New York and London in 1999, there are great challenges to bring domestic reserves management more in line with international practice, SEC methods and concepts of oil and gas reserves evaluation are having great shock on the domestic reserves calculation and management. Based on our decade years' experiences in domestic reserves calculation, examination and SEC reserves evaluation, this paper analyzes 5 methods in SEC reserves evaluation: analogy, volume, production decline, material balance and reservoir modeling methods; herein, we present the object, basis, scope and conditions in

application of each method; we also discuss key problems in decline method such as selection of decline mode, original point, decline rate and production unit,determining of stable production period and abandoned point,and the reasons for using of 2-stage-prediction method and decline method. These skills can provide important reference for SEC reserves evaluation and analysis, domestic reserves calculation and recoverable reserves calibration, and provide the proof of oilfield stable production.

Key words:reserve; dynamic evaluation; decline analysis; decline rate; reserve estimation method

Wang Shuhua,Exploration and Development Department, SINOPEC, Beijing City, 100728, China

Zhang Shoupeng, Teng Jianbin. Acidification technology and implementation of substep elutriation for low permeability reservoir-case of Xia 463 well in Linnan depression. *PGRE*, 2012,19(2):95-97.

Abstract:After stimulation, different well achieves different productivity for the low permeability sandstone reservoir. The key is that the stimulation scheme is not formulated based on the reservoir characteristics. Using the rock sections, cast sections, X diffraction analysis and mineral dissolution experiment techniques,we can accurately understand the characteristics of reservoir rock minerals, and then formulating the corresponding acidification techniques of sub-step elutriation. Using this technique for the low permeability reservoir of Xia 463 well herein, the microcosmic test content and methods for low permeability reservoir are discussed on how to correctly formulate process of acidification technique, as well as the field surveillance. Acidification scheme is proved successful by field operation. It is proved that this technique is not only important for production maintenance, but also for the control of water saturation in low permeability reservoir over a long period of time.

Key words:low permeable sand reservoir; matrix acidification;sub-step elutriation; interparticle material;compatibility

Zhang Shoupeng,Geoscience Research Institute, Shengli Oilfield Company, SINOPEC, Dongying City, Shandong Province, 257015, China

Wang Shihu, Zhang Zhiang, Wang Lei et al. MATLAB hydraulic fracture propagation simulation technique. *PGRE*, 2012,19(2):98-101.

Abstract:Hydraulic fracture simulation technique plays an important role in fracture design and evaluation. It has been developed for many years, however, it is mainly paying more attention to time efficiency and so on, petroleum engineers usually choose 2D or p-3D model for simulation. As we all know, with low accuracy step by step, finite difference method can not satisfy the requirement. What we want to do in this paper is just trying to establish a real 3D hydraulic fracture simulation technique in MATLAB with finite element method. And, then we compare it with the results of the mature commercial software such as GOHFER to improve the accuracy of the simulation and give more reference.

Key words:hydraulic fracture; finite element method; real 3D model; fracture propagation; numerical simulation

Wang Shihu, Oil Production Technology Research Institute, Shengli Oilfield Company, Dongying City, Shandong Province, 257000, China

Xue Shifeng, Wang Feifei, Wang Haijing. Numerical study of productivity ratio and factors of perforated well. *PGRE*, 2012,19(2):102-105.

Abstract:Perforated completion is widely used, in order to study the effect of perforation factors on perforation productivity ratio and get better perforation process selection, 3D finite element models with factors of perforation parameters (perforation depth, diameter, density and phase), compaction and damage for productivity ratio (PR) calculation in perforation completion are established in this paper. The code connecting software COMSOL and MATLAB are used to simulate and analyze 290 different models with their specific parameters. The effect of perforation depth, diameter, density, phase and compaction on perforation productivity ratio is obtained, and the flow pattern near perforation can be observed by the model. Considering oilfield practice, a simple method of PR calculation and the relationship of well PR and model PR are provided, which will be useful for evaluation of productivity and optimizing perforation completion design.

Key words:perforation completion; productivity ratio; influence factors; finite element model; perforation parameters

Xue Shifeng,College of Pipeline and Civil Engineering, China University of Petroleum (East China), Qingdao City, Shandong Province, 266555, China

Liu Ming, Zhang Shicheng, Mou Jianye. Dissolution pattern of radial wormhole model in carbonate acidizing. *PGRE*, 2012,19(2):106-110.

Abstract:In response to the questions of wormholing during carbonate acidizing, this paper derives a radial two-scale continuum model based on former researches, and studies the dissolving pattern and the effect of some key factors on it, and gets the conditions of the occurrence of wormholes. The results show that: the conclusions got from the models accord well with the experiments conducted by former researchers perfectly; with the rise of diffusion efficiency and decrease of injection rate, the diffusion effect becomes stronger relatively and it is easier to form face dissolution; with the decrease of diffusion efficiency and increase of injection rate, the convection effect becomes more apparent relatively, and it is easier to form uniform dissolution; the wormhole, which can provide adequate permeability and minimize the injection volume of acid at most, is formed when the effect of convection and diffusion is equivalent; the magnitude of heterogeneity has an optimal value, below which the wormhole density and breakthrough volume decrease under more heterogeneity, above which the wormhole density and breakthrough volume become insensitive to the heterogeneity.

Key words:carbonate; acidizing; wormhole; radial model; breakthrough volume; heterogeneity

Liu Ming,MOE Key Laboratory of Petroleum Engineering,China University of Petroleum (Beijing),Beijing City,102249,China