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Исследование возможности вовлечения

в сырье гидроочистки дизельной фракции биокomпонентов

В статье представлены результаты расчета оптимального соотношения дизельной фракции и фракции 180–240°C биокomпонента, полученного в ходе медленного пиролиза растительных отходов. Приведены сравнительные таблицы технологического режима работы реакторного блока гидроочистки и качества получаемых продуктов с вовлечением биокomпонента и без них.

Ключевые слова: биодизельное топливо, пиролиз растительного сырья, гидроочистка дизельной фракции, жидкий биокomпонент, смесевые биотоплива.

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Exploring the Possibility of Engagement in the Raw Materials of Hydrotreating the Diesel Fraction of Biocomponents

The article presents the results of calculating the optimal ratio of the diesel fraction and the 180-240 °C fraction of the biocomponent obtained during slow pyrolysis of plant waste. Comparative tables are given on the technological mode of operation of the hydrotreating reactor unit and on the quality of the products obtained with and without the involvement of the biocomponent.

Key words: biodiesel, pyrolysis of vegetable raw materials, hydrotreating of diesel fraction, liquid biocomponent, mixed biofuels.

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Нефтепродукты для северных территорий на основе процесса замедленного коксования

Рассмотрены возможные риски перепроизводства летних и межсезонных сортов дизельного топлива на НПЗ. Проведен комплексный анализ свойств узких фракций гидроочищенного при давлении водорода 80 атм. легкого газойля коксования. Рассмотрены зависимости изменения плотности, температуры помутнения, температуры начала кристаллизации, содержания ароматических углеводородов, серы и азота от утяжеления фракционного состава. На основании полученных данных из узких фракций скомпаундированы

компоненты реактивного топлива, зимнего и летнего дизельного топлива. Полученные смеси проанализированы на соответствие требованиям ГОСТов. Показана возможность получения из гидроочищенного при давлении водорода 80 атм. легкого газойля коксования реактивного топлива, зимнего и летнего дизельного топлива.

Ключевые слова: автоматическая дистилляционная установка PILODIST 400 CC, определение свойств узких фракций, легкий газойль коксования, дизельное топливо, реактивное топливо, установка гидроочистки под высоким давлением водорода, низкотемпературные свойства.

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Oil Products for Northern Territories on the Basis of Delayed Coking Process

Possible risks of summer and inter-season fuel overproduction at the Russian Federation oil refineries are reviewed. Comprehensive analysis of properties of coking light gas oil narrow fractions hydrotreated at hydrogen pressure of 80 atm is conducted. Dependences of changes in density, cloud point, chilling point, content of aromatic hydrocarbons, sulfur and nitrogen on weighting of fraction composition are considered. Based on the received data the components of jet fuel, winter and summer diesel fuel were compounded from narrow fractions. Received blends are analyzed for compliance with the requirements of corresponding GOSTs. The possibility to receive jet fuel, winter and summer diesel fuel from light coking gas oil at hydrogen pressure of 80 atm is shown.

Key words: *automatic distillation unit PILODIST 400 CC, determination of narrow fractions properties, light coking gas oil, diesel fuel, jet fuel, hydrotreatment unit under high pressure of hydrogen, low temperature properties.*

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Метод расчета ректификации многокомпонентных смесей в режиме полного орошения

В статье представлен аналитический метод расчета процесса ректификации многокомпонентных смесей в режиме полного орошения, основанный на заданных требованиях к качеству получаемых продуктов разделения. Описанный метод может быть использован как для дискретных, так и для непрерывных смесей. Приведен пример расчета по предлагаемой методике и выполнено сопоставление результатов с потарелочным расчетом рабочего режима колонны в программном комплексе для технологического моделирования. Анализ полученных данных показал, что значения составов дистиллята и остатка удовлетворяют заданным требованиям по суммарному содержанию примесей, а разработанный метод показывает хорошее соответствие основных параметров процесса с результатами современных программ для технологических расчетов и может быть рекомендован для практического применения.

Ключевые слова: ректификация, ректификационная колонна, режим полного орошения, многокомпонентная смесь, разделение смеси, расчет процесса ректификации, качество продуктов ректификации.

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Computation Method of Fractionation for Multicomponent Mixtures in the Total Reflux Operation

The article contains an analytical method for computing the fractionation process of multicomponent mixtures in the total reflux operation, based on the specified requirements for the separation products quality. The described method can be applied for both discrete and continuous mixtures. An example of the computation by the proposed method is given and the results comparance with the tray-by-tray simulation of the fractionating column operating mode in the technological software package is performed. The obtained data analysis shows that the distillate and the residue compositions meet the specified requirements for the contaminants content, and the developed method demonstrates good compliance of the main process parameters with the results of the modern technological software and it can be recommended for practical use.

Key words: *fractionation, fractionating column, total reflux operation, multicomponent mixture, mixture separation, fractionation process computation, fractionation products quality.*

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Моделирование процесса деградации рабочих жидкостей в гидравлических системах авиационной техники

Моделирование процесса деградации рабочих жидкостей в гидравлических системах авиационной техники выполнено на основе известных в химмотологии закономерностей и включает построение структурно-функциональной, физической (условий) и математической моделей процесса. Моделирование позволяет не только количественно изучать динамику процесса разрушения рабочих жидкостей, но и прогнозировать работоспособность гидравлической системы с учетом влияния состава и условий применения жидкостей. Приведены результаты моделирования на примере изменения вязкости и кислотного числа гидравлических жидкостей.

Ключевые слова: рабочие жидкости, гидравлические системы, авиационная техника, методы исследования, моделирование, интегральная оценка, прогнозирование.

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Modelling of Working Fluids Degradation Process in Aviation Hydraulic Systems

Modelling of working fluids degradation process in aviation hydraulic systems performed on the basis of well-known in chemmology objective laws; it includes construction of structural-functional, physical (conditions) and mathematical models of the process. Modelling allows to not only quantitatively examine the dynamics of working fluids destruction process, but also to forecast hydraulic system performance characteristics considering influence of fluids composition and operational conditions. Some illustrations of modelling results with regards to hydraulic fluids viscosity and acidity number changes are provided.

Key words: *working fluids, hydraulic systems, aviation, investigation methods, similarity, modeling, integral evaluation, forecasting.*

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Композитные волокна с фазово-переходными свойствами в качестве терморегулирующих добавок к сухим строительным смесям с возможностью бимодального нагрева

В работе изучены возможности использования композитных волокон с фазово-переходными свойствами в качестве терморегулирующей добавки к сухим строительным смесям с возможностью аккумуляции тепловой энергии под действием солнечного света и высокочастотного переменного магнитного поля.

Композитные волокна были получены путем адсорбции органического фазово-переходного материала эйкозана на волокна микрофибриллярной целлюлозы, модифицированной наночастицами магнетита.

Полученные композиты продемонстрировали удельную величину запасаемой тепловой энергии в диапазоне 129–148 Дж/г в зависимости от содержания эйкозана в их составе. Показано, что добавление 10–15% мас. композитных волокон к сухой строительной смеси позволяет запастись и высвободить тепловую энергию в отвержденных образцах в диапазоне температур 27–43°C, соответствующему плавлению и кристаллизации эйкозана в структуре композитных волокон. Показано, что добавление композитов влияет на динамику нагрева под действием искусственного солнечного света и последующего охлаждения: образцы с добавлением волокон продемонстрировали более интенсивный нагрев и замедленное охлаждение при достижении температуры 35°C по сравнению с контрольными образцами. Также образцы отвержденной смеси с добавлением композитных волокон продемонстрировали возможность аккумулировать тепловую энергию при воздействии высокочастотного переменного магнитного поля с ее последующим пролонгированным высвобождением.

Ключевые слова: фазово-переходные материалы, эйкозан, композитные материалы, наночастицы магнетита, магнитная гипертермия.

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Phase-Change Composite Fibers as a Thermoregulating Additive to Dry Building Mixes for Bimodal Solar/Electromagnetic Energy Storage

The work is devoted to the study of phase-change composite fibers as a thermoregulating additive to dry building mixes with the possibility to accumulate thermal energy under the sunlight heating or exposure to high-frequency alternating magnetic field. The composite fibers were prepared by adsorption of organic phase-change material eicosane on the surface of cellulose microfibers modified with magnetite nanoparticles. The resulted composites demonstrated the latent heat storage capacity of 129–148 J/g depending on the eicosane content. The addition of 10–15 wt% of the composite fibers to the dry building mix brought the latent heat storage and release properties to the hardened samples in the temperature range from 27°C to 43°C, which corresponds to melting and crystallization of eicosane in the composites structure. The addition of phase-change composites affected on heating of the hardened plaster under the simulated sunlight and its further cooling under ambient conditions. The samples demonstrated more intensive heating and reduced cooling rate upon reaching 35°C as compared to control samples. Additionally, the hardened plasters containing the phase-change composites demonstrated the capability to accumulate thermal energy under high-frequency alternating magnetic field exposure attended with its prolonged release.

Key words: *phase-change materials, eicosane, composites, magnetite nanoparticles, magnetic hyperthermia.*

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Нуклеация гидрата метана в присутствии нанофибриллярной целлюлозы

В работе изучена возможность замедления нуклеации газовых гидратов с помощью введения в систему дополнительных поверхностей. Данный процесс обычно протекает на фазовых границах, т. е. появление в системе новых поверхностей (твердых частиц) скорее должно повышать вероятность формирования гидратов. Изучено влияние диспергированных в воде нанофибрилл карбоксилированной целлюлозы (CNF) на образование гидрата метана при интенсивном перемешивании. Было выявлено, что в идентичных условиях введение 0,5% мас. CNF позволяет, во-первых, снизить скорость нуклеации гидрата и, во-вторых, подавить эффект «памяти», характерный при образовании гидрата из дистиллированной воды (DW). Анализ функций «выживания» позволил установить, что механизм ингибирующего действия CNF заключается в снижении количества центров нуклеации гидрата. Это можно объяснить участием CNF в нарушении сетки водородных связей: например, механическим разрушением докритических зародышей частицами ингибитора при интенсивном перемешивании. Полученные данные говорят о возможности разработки нового класса кинетических ингибиторов гидратообразования на основе дисперсий.

Ключевые слова: гидрат метана, кинетические ингибиторы гидратообразования, нуклеация, переохлаждение, эффект памяти.

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Nucleation of Methane Hydrate in the Presence of Nanofibrillar Cellulose

Is it possible to slow down gas hydrate nucleation by introducing additional surfaces into the system? This process usually occurs at phase boundaries, i.e., the appearance of new surfaces (solid particles) in the system should rather increase the probability of hydrate formation. In this work, the effect of carboxylated cellulose nanofibrils (CNF) dispersed in water on the formation of methane hydrate under intensive stirring was investigated. It was found that, under identical conditions, 0.5 mass% CNF allowed reducing the hydrate nucleation rate and suppressing the "memory" effect characteristic for hydrate formation from distilled water (DW). The analysis of the "survival" functions revealed that the mechanism of the CNF inhibitory action is to reduce the number of hydrate nucleation centers. This can be explained by the participation of CNF in the disturbance of the hydrogen bond network: for example, mechanical "destruction" of pre-critical nuclei by inhibitor particles under intensive stirring. The data obtained suggest the development of a new class of kinetic hydrate inhibitors based on dispersions.

Key words: methane hydrate; kinetic hydrate inhibitors; nucleation; subcooling; memory effect.

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Вклад глубинных углеводородов в формирование газогидратных залежей

Сопоставление компонентного состава углеводородных смесей, полученных в результате абиогенного синтеза в лаборатории при термобарических параметрах, сходных с условиями мантии Земли, с составом образцов природных газовых гидратов показывает их схожесть. Это подтверждает одно из положений концепции абиогенного глубинного происхождения углеводородов, согласно которому газ, входящий в состав газовых гидратов, может иметь глубинное происхождение. Залежи газогидратов могли образоваться в результате восходящей вертикальной миграции глубинных углеводородных флюидов по разломам и трещинам.

Ключевые слова: газовые гидраты, высокое давление, высокая температура, абиогенное образование углеводородов.

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Contribution of Deep Hydrocarbons in Gas Hydrate Formation

The reserves of hydrocarbons trapped in gas hydrate deposits are estimated to be enormous, especially comparing with the proven geological resources of natural gas. At the same time the origin of gas hydrate deposits is still debatable. Comparison of the component composition of hydrocarbon mixtures obtained as a result of abiogenic synthesis in the laboratory under thermobaric parameters similar to the conditions of the Earth's mantle with the composition of samples of natural gas hydrates shows their similarity. This confirms our suggestion about the possible

contribution of deep hydrocarbons in gas hydrate formation. Gas hydrate deposits could be formed as a result of upward vertical migration of deep hydrocarbon fluids along faults and fractures.

Key words: *gas hydrates, hydrocarbons, high pressure, high temperature, abiogenic formation of hydrocarbons.*

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Исследование низкотемпературной прокачиваемости флотского мазута

В статье представлены результаты исследований по разработке метода оценки стабильности низкотемпературной прокачиваемости флотского мазута при хранении, а также по влиянию его химического состава на указанную стабильность. Показано, что ухудшение низкотемпературной прокачиваемости флотского мазута определяется сочетанием факторов: содержание и молекулярно-массовое распределение высокоплавких алканов, содержание депрессорной присадки, а также объем хранимого топлива. Установлено наличие корреляции между результатами, полученными разработанным методом, и результатами оценки изменений температуры застывания образцов флотского мазута стандартным методом при их хранении в канистрах.

Ключевые слова: флотский мазут, подвижность нефтепродуктов, прокачиваемость нефтепродуктов, стабильность свойств.

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Research of Low-Temperature Flowability of Marine Residual Fuel

The research is devoted to development of method of estimation the stability of low-temperature pump-ability of marine residual fuels under its storage conditions in onshore reservoirs and tanks of sea vessels. Also there was explored the influence of chemical composition of these fuels on stability of their low-temperature pump-ability. It was found that decreasing of marine residual fuel's flow-ability is defined by combination of factors: volume of storing fuel, concentration and molecular-mass variation of solid paraffins and depressors. It's demonstrated the correlation between test results of the developed method and the results of pour point test in the progress of storage experiment of samples in the fuel-cans.

Key words: *marine residual fuels, flow-ability of oil-products, pump-ability of oil-products, stability of properties under the storage conditions.*

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Международный опыт в области целостности скважин

В статье рассматриваются вопросы, связанные с нормативами в области целостности скважин в таких странах, как Норвегия, Австралия и США, а также с совокупной оценкой рисков скважин на стадии эксплуатации. В основном обсуждаются вопросы, связанные с морскими скважинами (как придонными, так и платформенными), однако те же принципы могут быть применены и к скважинам, находящимся на суше. Показано, что при рассмотрении целостности скважин чаще всего совокупная оценка рисков сводится к непосредственному статусу изоляционных барьеров на скважине без учета взаимодействующих систем. Приведена возможная методика совокупной оценки рисков, которая может быть модифицирована под определенное месторождение и соответствующие риски. Предложен дизайн интеграционной системы.

Ключевые слова: целостность скважин, анализ риска, промышленная безопасность, совокупная оценка рисков, NORSOK, BSEE, NOPSEMA.

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International Approach to Well Integrity

The article covers aspects of the regulatory requirements to well integrity in such countries as Norway, Australia and USA. It also discusses cumulative risk assessment of well integrity in the operate phase of the lifecycle of the wells. The scope of the article primarily addresses offshore wells (both subsea and platform wells), however the same principles could be applied to the onshore wells. Commonly, the cumulative risk assessment covers only the status of the well barriers, excluding risks associated with the status of the interfacing systems. The article covers the methodology of the cumulative risk assessment which cover system interfaces external to well boundaries and which could be modified to address the specificity of each asset and corresponding risks. The article provides the design of an integrated cumulative risk assessment methodology.

Key words: well integrity, risk evaluation, process safety, cumulative risk assessment NORSOK, BSEE, NOPSEMA.

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Evolutionary Response Model of Low Maturity Coal Measure Reservoir Space to Temperature-Water Pressure under Hydrous Pyrolysis

As an important unconventional oil and gas resource, the exploration and development of coalbed methane has attracted more and more attention. Since coalbed methane mainly exists in adsorbed state, it is important to study the pore space characteristics of coal for the analysis and prediction of coalbed methane content. Thus, in order to explore the evolutionary characteristics of reservoir space during the thermal evolution of coal measure source rocks, two series of pyrolysis experiments as well as their corresponding pore structures were conducted. As the temperature and water pressure were the main factors to their organic matter and pores evolution, so temperature (250°C, 300°C,

350°C, 375°C, 400°C, 450°C and 500°C) and water pressure (10 MPa, 20 MPa, 30 MPa, 40 MPa, 50 MPa and 60 MPa) controlled experiments were analyzed. The experimental results show that temperature is positive to the organic matter evolution, and then in further promoted the development of pore structure. Namely, with the increasing thermal maturity, their corresponding pore volume, specific surface area as well as the numbers of macro-pores and micro-pores also gradually increased. But with the increasing water pressure, the pyrolysis productions did not changed obviously as well as their pore structures. It should be the reason of little effect of water pressure on organic matter evolution. Thus, the influence of water pressure on the development of pore structure is not significant compared with the variable temperatures, which has great influence on both liquid and gaseous hydrocarbons. Therefore, this study was helpful to the establishment of the linear equations on temperature and water pressure to the pore structures, which would be in further provide theoretical basis and guidance to the exploration and development of coals.

Keywords: coal seam, reservoir space, hydrous pyrolysis, pore evolution, temperature-pressure controlled.

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Design and Application of Impact Resistant PDC Bit for Glutenite Formation

In order to solve the problems of severe wear of cutting teeth and less bit footage of ordinary PDC bit in gravel stratum with strong abrasiveness and impact in the lower stratum of Dong ying North Zone. This paper introduces a design method of impact resistant PDC bit, and carries out simulation analysis, indoor experiment and field test on this design method. The test results prove that the designed impact resistant PDC bit has the advantages of high penetration rate and more footage, and verify the rationality and feasibility of the bit design.

Keywords: Sha-4 Zone, Glutenite Formation, PDC Bit, ROP.

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Research on Steam Simulation of the Formation and Gasification of Siliceous Rocks

The Nadan-Hatada formation developed during the Neogene Jurassic period and has been confirmed to contain light hydrocarbons. Through gold tube thermal simulation experiments, thermal degradation components analysis, and carbon isotope analysis, samples of shale from the Green River Formation in the Utah Basin and the Woodford Shale in Oklahoma were compared. The results showed that the gaseous hydrocarbons in the shale thermal degradation products mainly originated from the initial cracking of organic matter and the secondary cracking of liquid hydrocarbons. When the rumenite content was greater than 1%, the contribution of secondary cracking of liquid

hydrocarbons to gaseous hydrocarbons was significant. The production of gaseous and liquid hydrocarbons in shale and stony shale thermal degradation products was mainly controlled by the type of organic matter. The highest gaseous and liquid hydrocarbon production was observed in the I type of mudstone, while the lowest was in the III type of stony shale. The ^{13}C value of gaseous hydrocarbons in the I type of mudstone showed a local inversion when the rumenite content was less than 1.2%. This may be an indicator of low thermal evolution degree of I type of mudstone and the secondary cracking of liquid hydrocarbons into gases.

Keywords: gold tube hydrocarbon simulation, hydrocarbon components, carbon isotopes, Nandanhaka Fault System.

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Study on Plugging Mechanism of Gel Plugging Agent in Fractured Carbonate Oil Reservoirs

Estimates show that carbonate reservoirs contribute to 60% of the world's total oil and gas production, where fractured reservoir bodies are the most widely and commonly distributed. Among all materials for plugging fractured reservoir bodies, gel plugging agent is very suitable, for which can solve the problems of rapid increase of water cut and rapid production reduction of wells. However, the plugging mechanism of gel plugging agent in fractured carbonate oil reservoir is still unclear. In this paper, AM/AMPS phenolic gel was prepared. Besides, a microscopic visualization research system of fractured-vuggy carbonate reservoirs was designed and established independently, and the fractured core model was self-made. Through the core flow test and microscopic visualization experiment, the plugging performance and mechanism of gel plugging agent in fractured carbonate oil reservoir were thoroughly studied. The results demonstrated that AM/AMPS phenolic gel has selective plugging performance in fractures. After the system is gelled, it mainly plugs the water-bearing layer, with a water plugging rate as high as 99.82 %, and basically does not plug the oil-bearing layer, with an oil plugging rate of only 11.7%. It can be known that gel plugging agent has a plugging mechanism of mainly "inhibiting high-permeability reservoirs and unclogging low-permeability reservoirs", and it is characterized by "plugging without stopping". As a result, it can slowly migrate through high-permeability reservoirs and form a re-plugging.

Keywords: carbonate reservoir, fractured reservoir, gel plugging agent, plugging performance, plugging mechanism.

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Shale 3D Reconstruction Method Based on Context-Aware Generative Adversarial Networks and High-Resolution Optical Flow Estimation

Shale reservoirs are characterized by the presence of nano-micron pores in abundance, easy breakage due to bedding development, and difficulty in preparing true core samples. Therefore, 3D reconstruction of digital cores has become an important means of studying the microstructure features of shale. Currently, for shale matrix of dense reservoirs, existing deep learning-based reconstruction methods suffer from high costs and low accuracy, mainly due to the insufficient extraction capability of the networks for nano-micron pore features and low core resolution during reconstruction. To accurately predict the nano-micron scale pore structure of shale, we propose a shale 3D reconstruction method based on context-aware generative adversarial networks and high-resolution optical flow estimation (COFRnet-3DWGAN). This method optimizes the 3DWGAN(Wasserstein GAN) and high-resolution optical flow estimation networks by incorporating context-awareness, enhances the feature extraction capability of the networks to improve the learning degree of core nano-micron pores, and optimizes the core resolution by increasing the resolution of optical flow between core sequence images, thereby improving the accuracy of core reconstruction. The results show that, compared with WGAN, the proposed method is closer to the true core in terms of porous media morphological functions, porosity and permeability distribution, and pore structure parameters, indicating that this method has certain advantages in improving the accuracy of shale reconstruction.

Keywords: *digital core, 3D reconstruction, generative adversarial network, high-resolution optical flow estimation, context-aware.*

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Numerical Simulation of Fracture Initiation and Propagation in Oil Shale Horizontal Wells

With the development of economy, conventional oil and gas resources can no longer meet people's needs. Looking for additional oil resources has become one of the problems that must be solved at present. In recent years, the maturity of oil shale in-situ mining technology has made oil shale come into people's view again after two centuries. Oil shale is rich in reserves and has broad prospects for development, but the efficiency of oil shale in-situ mining is not high at present. Therefore, it is necessary to carry out hydraulic fracturing and fracture making transformation to increase the overheated area of oil shale. This can increase oil and gas transmission channels and solve the problem of low heating efficiency. Hydraulic fracturing treatment of oil shale to achieve short-term production increase is of great significance to ease the contradiction between energy supply and demand and promote healthy economic development. In this paper, ABAQUS software is used to study the initiation and propagation of water fracturing fractures in horizontal wells of oil shale. The main research contents and results are as follows: Analyze the fracture

initiation and propagation of oil shale horizontal wells. Based on the two-dimensional fracture model of oil shale horizontal wells, the simulation of complex fracture network formed by the intersection of hydraulic fractures and natural fractures is carried out by embedding Cohesive. It is concluded that the distribution of the width of the complex seam mesh is very different. It is in the shape of “wide in the middle and narrow around”. The seam length increases in a “ladder” way. This paper mainly studies the initiation and propagation of hydraulic fracturing fractures in horizontal wells of oil shale through theoretical analysis and numerical simulation. It is hoped that it can provide some reference for oil shale in-situ mining in the future.

Keywords: *oil shale, hydraulic Fracturing, ABAQUS, numerical Simulation, fracture.*

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Corrosivity of Wood Vinegar in Bio-Oil from Hazelnut Shells

Wood vinegar (WV) is the one of the primary liquid products of biomass pyrolysis, and applied as a sustainable chemical in industry and agriculture. The present work focused on the corrosivity of WV obtained from hazelnut shells pyrolysis to provide more sufficient premise reference for better application. It is found that, the optimal temperature for maximum WV yield (31.23 wt.%) was located at 700°C, the higher temperature (>700°C) was not conducive to the generation of WV, the low pH was important quality for WV, the average value of pH was 2.89 in the all selected temperatures, this is mainly attribute to the high content of phenols and acids in WV by gas chromatography-mass spectrometry technology, and phenols were the most important components, and accounted for above 41.17 wt.% in WV. Corrosive experiments showed that WV had the weaker corrosiveness than the typical formic acid, it was supported by the comparative result on the roughness, hardness, and tensile strength of the rubbers soaked in WV and formic acid, and the corrosivity decreased first and then increased with the increase of preparation temperature of WV, the WV prepared at 900 °C had the weakest corrosiveness, it revealed that the corrosivity of WV mainly were affected by the content of acids in WV, and more phenols supported the lower pH and lower corrosivity of WV, phenols were acidity similar to acids, the corrosivity were significantly less than acids.

Keywords: *hazelnut shells, pyrolysis, wood vinegar, corrosivity, phenols, acids.*

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Experimental Study on Dynamic and Static Rock Mechanical Properties of Tight Sandstone Gas Reservoir

The comparative study of dynamic and static rock mechanical properties of tight sandstone is of great significance to deepen the understanding of deep tight gas sandstone geological structure and improve the efficiency of oil and gas development. In this paper, taking the tight gas sandstone of the Sulige Gas Field as an example, experimental

research on the difference of dynamic and static elastic parameters under different temperature and pressure conditions was carried out. Furthermore, the mechanism causing the difference of dynamic and static elastic parameters under different measurement conditions is analyzed. The results show that the dynamic Young's modulus measured under reservoir conditions is greater than the static Young's modulus, and there is a good linear correlation between the dynamic and static Young's modulus of rock samples. But the correlation between dynamic and static Poisson's ratio is relatively poor. The existence of microfractures has great influence on the static deformation of rock. It is also found that the dynamic Poisson's ratio of rock decreases with the increase of pressure and temperature. The longitudinal and transverse velocity changes of rock under reservoir conditions are the result of confining pressure and temperature combined in the experiment. In the process of dynamic splitting and crushing of sandstone, the strain rate increases with the increase of impact pressure. The rock has certain rebound effect during unloading. The stress time history curve of sandstone samples is related to the change of impact loading rate and the fracture failure mode. In addition, the accurate evaluation of rock mechanics parameters has a significant impact on fracture prediction.

Keywords: tight sandstone, dynamic and static rock mechanics parameters, Young's modulus, Poisson's ratio.

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Recognition of Sand Bodies Based on Their Characteristics and Lithology

With the deepening of oil and gas exploration and development, the conventional seismic inversion technology has certain limitations for the fine research of complex reservoirs, and the actual production has high requirements for seismic resolution. The waveform indication technology is based on the waveform phase control mode, and uses the seismic waveform instead of the variogram. It can not only invert the wave impedance curve and realize high-precision prediction of the reservoir, but also simulate the characteristic curve reflecting the sensitivity of the reservoir to realize the reservoir under different parameters. characterization. Taking the second member of the Sangonghe Formation in the L block of the Manan slope in the Junggar Basin as an example, the sandstone changes rapidly laterally, has a small thickness, and has low conventional inversion resolution, making it unsuitable for predicting thin reservoirs. The waveform indication inversion was carried out to describe the distribution of the sandstone in the target layer, and the results were in line with geological understanding. After analyzing the relationship between the four properties of the reservoir, the oiliness of the sandstone in the target layer has a certain fitting relationship with the amplitude difference of the spontaneous potential curve. The reservoir indication simulation with the spontaneous potential curve as the characteristic curve was carried out. On the basis of the waveform indication inversion of the sandstone, further Oily sandstones were identified, and the simulation results were in good agreement with the drilling data.

Keywords: Manan slope, second member of Sangonghe formation, braided river delta, waveform indication inversion.

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Simulation of the Process of Discharging a Lithium-Ion Battery in Relation to the Sensitivity of Its Parameters

Research on heat generation for a Lithium-ion battery during the discharging process is of great practical importance. Mainly because the heat generation whilst discharging directly affects the safety, performance, and lifetime of the battery. This study proposes a method to analyze the heat generation in a battery model with regards to a series of physical and electrochemical parameters. A group of mathematical equations are developed to describe the electrochemical behavior. These equations are solved using finite element analysis. The report also studies the relationship of the generated heat of the battery with parameters such as the active material particle size, electrode surface density, and reaction coefficient. By optimizing the negative electrode particle size, the value of maximum temperature rising could be reduced by 10°C. The irreversible heat accounts for a large proportion of the total generated heat. By optimizing the electrode surface density, the maximum rise of temperature would be reduced by 21.6°C. The result shows that physicochemical parameters of the Lithium-ion battery have a significant effect on battery heat generation.

Keywords: lithium-ion battery, parameter sensitivity analysis, electrochemical-thermal model.

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Experimental Study on Geochemical Characteristics of Paleogene Source Rocks

The evaluation of geochemical properties of source rocks can provide an important basis for the accurate evaluation of hydrocarbon resources. In this paper, taking the Tanhai area of the Damintun Sag of Liaohe Oilfield as an example, the chemical properties of source rocks of the Dongying and Shahejie Formations of Paleogene are compared using a large number of geochemical and hydrocarbon generation thermal simulation results. The results show that the organic carbon content of the Dongying and Shahejie Formations in the study area ranges from 0.4% to 3.2%. It is considered that the source rock of the She 3 Member in Paleogene is good source rock. The Dong 3 and Sha 1 Members are the relatively good source rocks. While the Dong 2 Member is a relatively poor source rock, and the Dong 1 Member is the non-source rock. The vitrinite reflectance of Paleogene mudstone in the study area ranges from 0.33 to 0.93%, with an average value of 0.57%, which belongs to the immature to mature stage. Considering that the organic matter types in this area are mainly type IIB–III, the oil generation threshold is set at 2850 m. It is particularly noteworthy that thick coal measure strata are developed in the lower part of the Dong 3 Member and the upper part of the Sha 3 Member, although they are of poor type as oil source rocks, however, they are of great potential value as gas source rocks. The Shahejie source rock has the closest affinity with crude oil. Natural gas in the study area is mainly wet gas and a small amount is dry gas. The ratio of isobutane to n-butane (iC_4/nC_4) in natural

gas increased with decreasing depth, showing a certain migration differentiation effect. It is speculated that the Shahejie Formation source rock is the main source of natural gas in the Taiyangdao – Kuihuadao Structure.

Keywords: Liaohe oilfield, Damintun Sag, Paleogene reservoir, geochemical parameters, thermal simulation.

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The Effects of Heterogeneous Characteristics on Brittleness Index in Glutenite Reservoir of Calcareous Glutenite in a Particular Formation

In order to improve the fracturing reconstruction effect, it is necessary to carry out the research on the physical and mechanical characteristics of the target reservoir. The research on the microscopic characteristics of the reservoir is an important part of the reservoir evaluation, and also an important reference for the research on the rock mechanics properties of the reservoir. This article systematically studies the effects of different particle sizes, particle contents, gradation, and sample sizes on the mechanical failure characteristics and crack propagation morphology of sandy gravel based on numerical simulation methods. The results indicate that when the particle size is 1mm, the traces of damage are not obvious. Afterwards, as the particle size increases, the degree of damage gradually increases, and the complexity of cracks also increases; As the particle content increases, the degree of damage to the specimen gradually increases. The higher the content, the more severe the degree of fracture, and the complexity of crack formation increases; When matrix: fine: medium: coarse – 5:1:2:1, crack propagation is the most complex. Overall, the majority of cracks are "herringbone shaped"; As the width of the sample increases, the degree of damage on the upper part of the specimen gradually increases and gradually spreads downwards. The results will help clarify the law of crack propagation and provide theoretical support for optimizing fracturing construction parameters.

Keywords: heterogeneity, glutenite, brittleness index, PFC.

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Simulation of Vector Electric Dipole Source Response in Homogeneous Earth for Petrochemical Resource Exploration

Extensive observation examples have verified that the processes of earthquake development and occurrence are accompanied by seismic electromagnetic anomalies. Some of the electromagnetic emission phenomena, such as seismo-electromagnetic signals, electro-kinetic emission near the water driven front in oil reservoirs and low frequency leaking signals from deep based protective engineering, can be treated as the low frequency vector electric dipole source underground. In this study, the equivalent electric dipole generated by the seismic electromagnetic anomaly in a homogeneous Earth was numerically simulated, focusing on the spatial distribution characteristics of the electric dipole source response in any direction in the Earth. By simulating the dipole source responses for

different sources and geoelectric parameters, the distribution characteristics of the electric dipole source response in the Earth was analyzed and discussed. The results of this analysis provide a basis for the observation, identification, processing, and interpretation of seismic electromagnetic signals. Information about seismo-electromagnetic source distribution and time variation can be used for evaluating possible earthquake hazard as well as to study the mechanism and time evolution patterns of seismogenic process.

Keywords: *seismic electromagnetic anomaly, electric dipole source response, numerical simulation, propagation characteristics.*

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Predicting the Distribution of Calcareous Glutenite in a Particular Formation

Mahu oilfield is the largest tight glutenite oilfield discovered in China, with a reserve of 1 billion tons, and has a good development prospect. However, the tight glutenite reservoir is characterized by strong heterogeneity, low porosity and low permeability, and is difficult to develop. Calcareous conglomerate was encountered during drilling in many reservoirs of Baikouquan Formation in the fault block of the Xia 72 well in the Ma 13 well block of the Mabei Oilfield, resulting in the deterioration of the physical properties of the reservoir and the decrease of gas logging or oil content, which not only reduced the formation drilling encounter rate, but also affected the later deployment of horizontal wells. The genesis, identification and distribution of the calcareous glutenite of the Baikouquan Formation in Mahu Depression were studied based on core data, thin section identification data, logging data and seismic data. The results show that the study area has a good combination of upper and lower strata which supplied both material and environmental conditions for the formation of calcareous glutenite. The calcareous cements of the calcareous glutenite were formed in the late stage of diagenesis, and their distribution are mainly controlled by sedimentary facies and early faults. The calcareous glutenites have bright-point reflection characteristics in seismic, and their distribution characteristics can be accurately reflected by the maximum amplitude attribute.

Keywords: *Mabei oilfield, Baikouquan formation, calcareous glutenite, sedimentary microfacies, faults, controlling factors.*

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Comprehensive Reservoir Comparison Technique

for Complex Reservoirs

To address the challenge of stratigraphic correlation and division in exploration and development caused by the diverse sediment sources, complex internal structure, and rapid lateral changes of gravelly fan deposits in the Guojuzi depression steep slope, a comprehensive technique for sequence-based stratigraphic correlation and division of complex reservoirs has been proposed. This technique includes several aspects such as the methodological basis, correlation method, and modification method. The methodological basis involves multi-well precise calibration of target layers, determination of high-frequency sequence stratigraphy division scheme, and seismic constraints. The correlation method includes several techniques such as stratigraphic correlation under the control of stratigraphic unconformity structure, sedimentary pattern control, facies sequence comparison, marker bed method, and contour stratigraphy correlation. The modification method mainly includes stratigraphic thickness method, fluid property method, and structural method, which are used to correct the results of stratigraphic correlation. Based on this technique, a high-order sequence stratigraphic framework has been established, which involved the precise calibration of target layers using seismic, stratigraphic structure, sedimentary facies, facies sequence, marker beds, and contour constraints, followed by the application of correction methods such as stratigraphic thickness, fluid property, and structural analysis. A total of 26 five-level sequence stratigraphic frameworks have been established through high-frequency sequence correlation.

Keywords: *complex reservoir, sequential division and comparison comprehensive method, level division, multi-well fine calibration, stratigraphic structure.*

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The Influence Law and Mechanism of CO₂ Injection Pressure on Coal Rock Pore-Fracture Characteristics

In order to clarify the characteristics of coal rock pore fracture changes after CO₂ gas injection into coal seams, the Dafosi coalfield in Binchang mining area was taken as the research object. The changes in CT scanning surface, pseudo color, grayscale mean, and porosity of coal and rock samples were studied under different CO₂ injection pressures, Through CT scanning experiments, combined with ORS visual and Matlab software. The main reasons for the changes in pore fracture characteristics of coal and rock after injecting CO₂ gas were studied from three aspects: compressive deformation of coal and rock, crack width, and number of cracks. The experimental results showed that, as the injection pressure of CO₂ gas increases, the color of coal rock CT scan images and pseudo color images becomes lighter, the mean gray level increases, and the porosity decreases; The compression deformation of coal rock is not the main reason for the changes in the characteristics of coal rock pores and fractures; The more CO₂ gas is

adsorbed by coal and rock, the narrower the cracks gradually, and the number of pores and fractures decreases. CO₂ adsorption is the main reason for the decrease in porosity of coal and rock. The research results provide a technical boundary reference for the development of coalbed methane injection CO₂.

Keywords: coal rock, CO₂ injection pressure, gas adsorption, pores.

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Description of Formations Fault Activity Characteristics and Genesis Mechanism

Using of Palaeogeomorphic Restoration Techniques

The Xujiaweizi Fault Depression has experienced multiple stages of tectonic activity and its geological conditions are complex. Palaeogeomorphic restoration can provide a new idea for efficient exploration of oil and gas. At present, there is no systematic study on paleo-geomorphology restoration in the Anda Sag of the northern Xujiaweizi Fault Depression. In this paper, a large number of drilling and seismic data have been used to study the fault activity characteristics and genesis mechanism of the Anda Sag based on the structural analysis theory. Furthermore, the paleogeomorphology of the Anda Sag was restored. The study shows that the NE and NW trending preexisting boundary normal faults and the near E-W trending extensional activities controlled the formation and development of the Xujiaweizi Fault Depression. The Shahezi Formation had low extensional intensity in the early stage and was dominated by NE and NW trending fault activities. In the late period, it was dominated by S-N trending fault activities with high extensional intensity. The mechanism of formation denudation in the Anda Sag includes regional uplift and reverse extrusion deformation. The distribution of fault depression structures and main troughs of the Shahezi Formation in the Anda Depression have good inheritance characteristics. The denudation of the edge strata and the inner extrusion reversed zone is relatively serious, and most of the residual strata are in the delta front and lacustrine sedimentary development areas. Therefore, effective source rocks are developed in the residual formation areas, which are conducive to the formation of deep self-source gas reservoirs.

Keywords: gas reservoir, Xujiaweizi fault depression, preexisting structure, palaeogeomorphology, fault system.