

## SUMMARIES

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Dudek J., Janiga D., Wojnarowski P.: **An analysis of the influence of fracturing technological parameters on fracture propagation using numerical modeling** • AGH Drilling, Oil, Gas 2017 • Vol. 34 • No. 3

Nowadays, hydraulic fracturing is one of the most common treatments for both conventional and unconventional fields, a stimulation technique designed to increase well production through the reduction of flow resistance caused by the drilling process or genuine reservoir properties. In this article the planar, three-dimensional numerical model of hydraulic fracturing treatment is presented. Based on the given model, the influence analysis of the basic technological parameters of the fracturing in a directional well on fracture propagation was conducted. The presented analysis shows the crucial role of numerical modeling in the process of hydraulic fracturing treatment design. The outcomes allowed us to identify the sensitivity of the obtained fracturing effects on the change of the treatment of technical parameters.

**Keywords:** *hydraulic fracturing, numerical modeling, GOHFER 3-D*

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Dubiel S., Śliwa T., Kowalski T., Stryczek S., Wiśniowski D., Bieda A., Piwowarczyk S., Beszłej J., Naklicki M.: **The impact of diatomite on the thermal conductivity of solidified grout** • AGH Drilling, Oil, Gas 2017 • Vol. 34 • No. 3

The use of suitable materials for the preparation of sealing grout is an important issue from the point of view of the correct construction of borehole heat exchangers and geothermal wells. The minimization of the loss of heat during the transport of thermal water in geothermal wells can be achieved by use of sealing slurries with reduced thermal conductivity. Such slurries are also recommended in the upper part of deep borehole heat exchangers and the upper part of energy piles. The publication describes the impact of the addition of diatomite as a material lowering the thermal conductivity of solidified grout.

**Keywords:** *heat exchangers, geothermal wells, diatomite*

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Włodek T.: **The retrograde condensation problem in natural gas pipeline transportation system** • AGH Drilling, Oil, Gas 2017 • Vol. 34 • No. 3

Natural gas prepared for pipeline transportation must have appropriate parameters described in norms and standards. This entails a restrictive approach to acceptable changes in the composition of the natural gas in pipeline transmission system. The greater number of entry points to the pipeline transmission system causes a greater probability of natural gas diversity in terms of the content of its individual components. It particularly concerns the natural gas sources in which treatment methods are not sufficiently accurate and also imported gas. In specific cases where natural gas with a higher content of heavier hydrocarbons such as propane and butane will enter the transportation system, it is possible for the phenomenon of retrograde (reverse) condensation to occur. The occurrence of the two-phase system significantly worsens the pipeline transport conditions, causing significant pressure drops of transported natural gas. The article examines cases where the phenomenon of retrograde (reverse) condensation occurred in the pipeline transportation of natural gas.

**Keywords:** *natural gas, reverse condensation, pipelines, natural gas pipelines*

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Toczek P., Wiśniowski R., Stryczek S., Ziaja J., Mazur C.: **Total Specific Energy (TSE) as a new indicator of drilling efficiency** • AGH Drilling, Oil, Gas 2017 • Vol. 34 • No. 3

Knowing the data from drilling works which had been carried out in a given area gives the opportunity to develop the next borehole with great precision. An important element of the design is to analyze and interpret data in detail, which can be used during the following drilling process. Based on a literature analysis, certain methods of the selection of drill bits have been indicated. Mechanic specific energy curves of drill bits applied in drilling works in northern Poland have been compared. The drilling works took place in the Precambrian platform. The compared mechanic specific energy curves were calculated with the use of R. Teale and H. Rabia equations. A relation between mechanical specific energy and pressure loss in polycrystalline diamond compact drill bits was determined. New drilling ratio TSE – Total Specific Energy which considers hydraulic power energy in the nozzles of the drill bit was calculated.

**Keywords:** *selection of drill bits, Precambrian platform, mechanical specific energy, drilling unit cost, mechanical efficiency index, TSE – total specific energy*

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Jamrozik A.: **Graphene and graphene oxide in the oil and gas industry** • AGH Drilling, Oil, Gas 2017 • Vol. 34 • No. 3

Presently, nanotechnology and nanomaterials have found a number of applications in drilling, exploration and production (E&P) works, as well as in the area of refinery and distribution of crude oil and natural gas. Nanomaterials enjoy considerable popularity owing to their new and unique features which differentiate them from classical materials. Graphene is a relatively new material. Currently it occupies the seventh position among the most commonly used nanomaterials in oil and gas industry. This paper presents the properties graphene and graphene oxide and gives an insight into the applicability of graphene and graphene oxide in the oil and gas industry.

**Keywords:** *drilling, nanotechnologies, graphene, graphene oxide*

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Stryczek S., Gonet A., Wiśniowski R., Złotkowski A.: **The influence of selected liquefiers on the rheological parameters of cement slurries** • AGH Drilling, Oil, Gas 2017 • Vol. 34 • No. 3

The rheological properties of sealing slurries are very important when designing and executing cementing jobs and reinforcing ground and rock mass with the use of drilling technology. In order to ensure a high level of efficiency, the applied sealing slurries should meet several requirements. One of the most important criteria is pumpability. The rheological model and the rheological parameters of the sealing slurries should be properly selected to ensure efficient pumping. On this basis the flow resistance of the slurry in the circulation system can be calculated. The paper presents the results of laboratory experiments on the influence of some liquefiers on the formation of rheological properties of cement slurries used for sealing and strengthening rock mass, and for cementing jobs.

**Keywords:** *cement slurries, liquifiers*

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Kuczyński S., Włodek T., Smulski R., Dąbrowski K., Krakowiak M., Barbacki J., Pawłowski M.: **Application of Raman spectroscopy analysis in unconventional natural gas reservoirs – density and pressure dependence on Raman signal intensity** • AGH Drilling, Oil, Gas 2017 • Vol. 34 • No. 3

This paper contains information about Raman spectroscopy, describing its possible application in the oil and gas industry. This method allows the performance of a series of repetitive measurements to determine the composition of samples and its changes with high accuracy. In the article, the data presented in the literature connected with Raman spectroscopy and the oil and gas industry is analyzed. This paper considered measurements of a natural gas composition in simulated in-situ conditions performed using Raman spectroscopy. The current research project is trying to develop a mobile apparatus which would use Raman spectroscopy for defining reservoir fluid compounds in high pressure and high temperature conditions. The preliminary measurements were carried out in the simulated in-situ in variant pressure conditions.

**Keywords:** *Raman spectroscopy, unconventional natural gas, fiber optic, PVT, hydrocarbons*

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Kułynycz V.: **The influence of wettability on the petrophysical parameters of reservoir rocks** • AGH Drilling, Oil, Gas 2017 • Vol. 34 • No. 3

Knowledge of the reservoir rock wettability and its influence on petrophysical properties is a key factor to determine the mechanisms and assess the efficiency of oil recovery. In the reservoir rock at the presence of different liquids, it is very important to obtain information about the type of wettability of the rock. Since the understanding of the relationship between wettability and distribution of water and oil in the pore space is necessary to assess the efficiency of oil recovery. Wettability is one of the main parameters that determines the position of the liquid in the reservoir pore space and fluid flow. Wettability affects the properties of petrophysical rock containing hydrocarbons, among others, saturation, capillary pressure, relative permeability, electrical properties of reservoir rocks. Also affects the multiphase flow in porous media. The aim of this article is to characterize the petrophysical parameters of rocks dependent wettability, an overview of the research state of the impact of wettability on the selected petrophysical parameters and presents directions of the future research.

**Keywords:** *petrophysical parameters, wettability, capillary pressure, saturation, relative permeability*

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Kułyńcz V., Janowski P.: **Comparison of the oil recovery between waterflooding and CO<sub>2</sub>-EOR method for the JSt oil reservoir** • AGH Drilling, Oil, Gas 2017 • Vol. 34 • No. 3

Exploitation of oil from the reservoir initially is performed by primary methods that use natural energy reserves, that allows for partial exploitation of geological resources (30%). Further oil resources depletion requires the implementation of appropriate methods to support exploitation, secondary methods, consist mainly in the physical oil displacement and third methods, in which additional types of energy aid the process of exploitation. The use of this methods may contribute up to a twofold increase in the degree of the geological resources depletion. One way to increase the exploitation is the injection of CO<sub>2</sub> into the oil fields (CO<sub>2</sub>-EOR). This gas interacts physically and chemically on the reservoir rocks and oil contained in them, improving the conditions of its production. The technology of CO<sub>2</sub> injection into the reservoir allows not only to increase oil production, but also gives the possibility of storing this gas in reservoirs, which is beneficial from the viewpoint of its impact on the environment. In the article was made a comparison of the oil recovery effectiveness between waterflooding and CO<sub>2</sub>-EOR method for Jastrząbka Stara reservoir. For this purpose, were made simulations of waterflooding and injecting CO<sub>2</sub> for selected oil reservoir on the basis of the CO<sub>2</sub>PROPHET program. We analyzed different variants of injection of water and gas, both the amount of injected media, and the method of injection (only water, only gas, change injection of gas and water). Based on the results of modeling was estimated the amount of oil possible to extract by both methods and the recovery factor of the geological resources of the selected oil reservoir.

**Keywords:** *waterflooding, CO<sub>2</sub> injection, oil, recovery factor*