

SUMMARIES

Moslavac B., Matanović D., Pašić B.: **Characterization of Swelling Packer EPDM Elastomers** • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

Since many years different elastomer types have been applied in a number of oilfield completion solutions. With regard to harsh environment elastomers have to withstand sometimes, it is crucial to design long lasting products resilient to high temperature and aggressive fluids able to deal with high differential pressures at the same time. Swelling packers appear to be a real challenge to design. A frequent question may be what type of rubber to use in swelling systems to compensate high temperature and high pressure conditions. This paper is based on methodology and characterization of vulcanized ethylene-propylene-diene monomer (EPDM) samples submitted to swelling in a glass dish and OFITE dynamic linear swell meter. Several different recipes for rubber vulcanization were used and tested trying to combine and mix different concentrations of each component. The swelling of rubber samples was tested in oil acquired from one of the Croatian oil fields at room temperature and 90°C. A significant difference in swelling intensity and speed was observed when comparing these two conditions. Swelling properties were carefully scaled imposing conclusions given at the end of the paper.

Keywords: *completion solutions, swelling packers, EPDM rubber*

Knapik E., Janiga D., Wojnarowski P., Stopa J.: **The role of capillary trapping during geologic CO₂ sequestration** • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

Capillary trapping is thought to be one of the primary CO₂ fixing mechanisms in a porous medium when it is stored. While CO₂ is injected, gas displaces formation water (brine) in the process called drainage. In the case of the rock mass wetted by water, formation water remains adsorbed in wall pores and micropores. Once the injection process has been completed, gas is displaced by the natural water in the process referred to as imbibition. In that way CO₂, being a non-wetting phase, is held in the form of dispersed bubbles as an immobile phase. The process occurs fast and allows for a regular storage of large amounts of CO₂. The process is dependent upon numerous parameters, including capillary pressure and contact angle, but such measurements cannot be easily taken for rock cores in reservoir conditions. Another problem is the fact that it is difficult to separate the impact of such mechanisms as dissolution and mineral trapping. So far capillary trapping has been deeply analyzed in terms of hydrocarbon recovery and contaminant remediation. The goal of this article is to:

- present a physiochemical basis of capillary trapping in CCS context,
- simulate the impact of relative permeability hysteresis on geological CO₂ storage.

Keywords: *capillary trapping, CO₂ sequestration, relative permeability hysteresis*

Blicharski J.: **An evaluation of hydrocarbon deposit tightness in aspect of CO₂ sequestration** • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

Depleted hydrocarbon deposits due to large capacity and proven tightness are often considered as prime candidates for CO₂ sequestration in geological structures. The tightness of these structures is mainly connected with the existence of water saturated overburden rocks of very low permeability which form a natural barrier for the migration of hydrocarbons. This paper explains the sealing mechanisms of caprocks resulting from capillary forces at the interface of hydrocarbon – water and carbon dioxide – water contact. Other ways of caprock leakage due to rock fracturing or reactivation of natural faults and fissures were also investigated.

Keywords: *trap tightness, capillary pressure, diffusion, sealing rocks, breakthrough pressure, CO₂ sequestration*

Bujok P., Klempa M., Labus K., Porzer M., Pánek P., Rado R., González-Rodríguez M.A.: **CO₂ storing capacity in geologic formations in the Czech Republic** • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

The CO₂ emission is a significant environmental problem threatening the sustained development of mankind. One of the possible ways of limiting the emission is the disposal of carbon dioxide in geologic formations.

A pilot project of CO₂ storage in geologic formations in the Czech Republic (REPP-CO₂) is presented in this paper. The project is part of the Norwegian Fund and the research consortium (headed by the Czech Republic Geologic Office), with VSB-TU Ostrava as a participant. The VSB-TU Ostrava is represented by the Faculty of Geology and Mining (HGF) and the Faculty of Metallurgy and Materials Science (FMMI) in the consortium.

The research activity of the consortium mainly focuses on the development and improvement of selected laboratory methods, modelling and simulation, which are basic for the evaluation of safety of CO₂ storing in geologic formations. This paper presents the research conducted by the Faculty of Geology and Mining (HGF) VSB-TU Ostrava within the project.

Keywords: *CO₂ storage, CO₂ storage in geologic formations in the Czech Republic, boreholes for CO₂ storage, modelling of CO₂ storage, laboratory methods for CO₂ storage*

Wysocki S., Wiśniowski R., Ryznar D., Gaczoł M.: **Linear Swelling Test (LST) of clay formation under the influence of newly developed drilling fluids with the addition of cationic polymers** • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

This paper shows research of Linear Swelling Test (LST) of shale rocks under the influence of three drilling muds with different cationic polymers. Tested polymers have been synthesized at the Drilling, Oil and Gas Faculty of AGH UST Krakow. Research findings indicate that synthesized polymers as well as developed on its base drilling fluids effectively inhibit hydration and prevent the disintegration of clay formation.

Keywords: *drilling mud, polymers, shales, LST*

Dhital Ch., Knez D., Śliwa T.: **Geomechanical aspects of hydraulic fracture propagation in the Lublin shale gas field in Poland** • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

The recent boom in shale gas exploration around the world has sparked a paradigm shift in energy security in many countries in the world. With the successful exploration of shale gas production in the United State's, many operators are trying to replicate the success in other parts of the world specifically in European countries where the presence of organic rich shale deposits have signaled a promising investment for the recovery of shale gas. Perspective studies for the Polish shale gas field in Poland have been ongoing. One part of this project is the comparison of hydraulic fracture thickness between the U.S shale gas field and Polish for better and effective design and modeling of reservoirs for the optimal exploration and recovery of shale gas. Successful production of natural gas from Polish basins requires a hydraulic fracture stimulation to unlock the gas trapped in the shales coupled with a geologic analysis of the shale rocks.

Keywords: *shale gas, hydraulic fracture simulation*

Janusz P., Liszka K., Łaciak M., Oliiynyk A., Susak A.: **An analysis of the changes of the composition of natural gas transported in high-pressure gas pipelines** • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

Natural gas is one of the major fuels covering home demand for energy. Natural gas consumption has been observed to systematically increase over the last five years. Intensive works are conducted on the development of the national gas network leading to the diversification of directions and sources of blue gas. Natural gas consists of various components. Its composition depends on the source of origin and has a decisive influence on thermodynamic and hydraulic properties. The content of heavy hydrocarbon gases increases the calorific value of the gaseous fuel,

whereas the high content of inorganic components lowers the amount of energy obtained in the course of natural gas combustion, and environmentally hazardous chemical compounds are formed.

As far as gas transport is concerned, too high content of heavy hydrocarbon gases (propane, butane, pentane) is disadvantageous. In high pressure conditions the C3-C5 class gases change to a liquid phase. This results in the change of the calorific value, lower hydraulic efficiency of the pipeline diameter and potentially faster corrosion processes on the inner surface of the pipeline.

This paper is aimed at presenting results of changes of natural gas composition in a function of distance at which the fuel is transported. The respective analyses will be conducted with the use of analytical methods and commercial pipeline simulators.

Keywords: *natural gas, transmission system*

Mandryk O.M., Pukish A.V., Mykhailiuk Y.D.: An assessment of the influence of the main oil industry technological processes on the environment • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

This article discusses the main dangerous ecological factors of influence of each individual technological process element of oil production on the environment, namely: preparation of the ground for well construction, oil production, transportation of well production, its storage in reservoirs, and storage of the oil industry wastes. There was developed a primary classification of the characteristic influences of the main oil industry technological processes onto the environment.

Keywords: *oil production, ecological factors of influence on the environment, oil production technological process*

Paliychuk I.: Elastic interaction of couplings and pipes walls in tight threaded joints • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

Box threaded connections of pipes are used at oil and gas recovery. The pipe and the coupling interact elastically by their tapered surfaces with radial tightness in the thread and the sealing. Strength and impermeability of the connection depends on this interaction.

The pipe and the coupling are thin-walled cylinders with the linear variable wall thickness. Their sections have varying lengthwise rigidity of walls and axial-symmetric bends. Therefore, their calculation differs from the Lamé problem and from the calculation of cylinders with the fixed wall thickness.

Physical and mathematical principles of the calculating parameters of elastic-strained state of all parts of pipe walls and coupling connections with the sealing box have been formulated in the article.

Keywords: *oil and gas recovery*

Rzyczniak M., Rzyczniak A.: Creation of the environment of wetlands with the use of drainage • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

In the article there was represented the example of a project concerning dehydration of agricultural lands located in Rzozów in the area of Skawina commune, administrative district of Kraków in Małopolska, around 16 km long distant to the west – south from the city centre of Kraków. The analysed land is being under the disadvantageous hydro and air conditions, what results in the significant decrease of grounds quality and plants crops as the consequence. In order to improve the quality of grounds and dehydrate the excess of water, there was designed a dehydration system consisted of open drainage ditches and underground drainage network. The aim of those operations is to improve the ground structure quality and it's access to air, thus to increase the plants crops from the presented area.

There were lead numerous calculations such as hydrological calculations, hydraulic calculations in order to define type and height of drainage ditches consolidation and the height of collector mouths over the ditch bottom, calculations of drains spacing and the excavation capacity.

As the final effect, it was assumed to excavate two drainage ditches, one on the northern side and one on the southern side of the area. The network of drains and collector connected to the ditches is to drain off the spare water from the considered land.

Keywords: *ground dehydration, drainage, natural environment creation*

Rychlicki S., Kosowski P., Wartak J., Solecki M.: Social acceptance for CO₂-EOR and CCS projects based on survey conducted in southeastern Poland • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

This paper presents the results of a survey on the public acceptance of CO₂-EOR and CCS methods. The survey has been conducted in southeastern Poland, on a sample of people living in the Carpathian region (Krosno, Jedlicze, Rymanów). Existing local reservoirs are taken into account of the possibility of enhanced oil recovery by injecting carbon dioxide. A survey has been done within the MUSE project to determine the impact of oil on the surrounding environment and the level of knowledge, perception and acceptance of CCS and CO₂-EOR methods. As appeared from the survey, public acceptance development of the oil industry in Poland is quite positive. Respondents recognize the need to use modern technologies such as CO₂-EOR and CCS to fulfill this task. A significant number of respondents show limited awareness (or lack of it) regarding these technologies. Public acceptance largely depends on the level of knowledge regarding the technology. One of the main directions of work undertaken prior to the implementation of industrial installations using technologies of CO₂-EOR and CCS should be gaining the acceptance of the local community.

Keywords: *CCS, EOR, social acceptance, survey, Poland*

Jamrozik A., Stryczek S., Wiśniowski R., Gonet A., Wójcik R.: An application of organic nanosilica to cement slurries based on Portland cement • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

More and more attention is paid nowadays to the quality and durability of the applied cement slurries. Apart from the appropriate rheological, technological and strength parameters, the slurry should be resistant to the strongly mineralized reservoir waters

Appropriate phase composition of cement slurries, especially high CSH content is responsible for the change of pore structure in the cement slurry; the number of fine gel pores which are not available for the fluid increases and the number of capillary pores responsible for the transport of corrosive factors inside the cement slurry decreases.

The use of nanosilica as an additive improving the properties of cement slurries has recently gained popularity. Bearing in mind these properties of nSiO₂, there were conducted laboratory experiments on the use of organic nanosilica for cement slurries based on Portland cement CEM I 52.5 R.

Keywords: *cement slurries, nanosilica*

Iwona Kowalska-Kubsik: Numerical simulation of drilling fluid flow in annular the space of the borehole • AGH Drilling, Oil, Gas 2015 • Vol. 32 • No. 4

This paper presents the numerical results of a numerical analysis of drilling fluid flow through annular space in the borehole. The analysis used the Herschel–Bulkley rheological fluid model. The obtained results of the analysis for three cases with variable geometry. Variable geometry is associated with a larger diameter drill in the joints of drill pipes, and consequently, with reduced flow cross-section. A comparison of pressure values at the end of the analyzed examples showed that in the example of a simple drill pipe without joints, pressure values were 30% higher than in the case, which takes into account changes in the geometry of the joints.

Keywords: *numerical simulation, fluid flow, drilling fluids, rheological models*
