Contribution ID: **770** Type: **Oral Presentation**

Approach for void space reconstruction on a microchip based on the lithological and mineralogical data

Thursday, 16 May 2024 12:20 (15 minutes)

Tight gas reservoirs are the subject of interest to many researchers because of the large oil and gas deposits concentrated in them. These low porosity and permeability sandstone reservoirs are widespread worldwide. Enhanced oil recovery methods are widely used in the industrial development of such deposits. These methods require numerous preliminary coreflooding experiments on rock samples, which are expensive and, in many cases, impossible to perform, having only one sample because coreflooding tests almost always consist of multiple steps.

Therefore, we assume replacing the structure of a real core void space with a similar artificially created geometry inside a silicon microfluidic chip that can be used many times in flooding experiments without damaging the core-prototype sample. However, it is crucial to take into account such parameters as wettability, pore size, pore distribution, length, width, and tortuosity of pore channels, et al. A special role in studying such parameters is always assigned to the relationship between the lithological and mineralogical characteristics of the rock with its structure of the void space according to microtomography (MCT) data.

The current research aims to identify features of the mineral matrix of studied tight gas sandstone reservoirs, which most intensively influenced the void space structure. The study represents preliminary work before conducting flooding tests on microfluidic chips with heterogeneous wettability to limit water inflow. We have used such methods as MCT data, lithological study rocks in cross-sections, X-ray diffraction analysis, grain-size analysis, and mineralogical composition by scanning electronic microscopy. As a result of current studies, we have determined that all rocks with different permeabilities have almost the same mineralogical composition. The difference is that the mineral matrix of rocks with low permeability has a higher content of secondary calcite minerals. Most of the macropores (>2 μm) identified by MCT data were caused by secondary leaching of plagioclases. Most of the microporosity (<2 μm) is associated with clayey chlorite cement. Primary porosity is almost entirely replaced by secondary silicification due to the intense secondary transformation of sandstones.

The second part of the current study was dedicated to the creation of void space structures in microfluidic chips using the complex of lithological, mineralogical, and, to a greater extent, MC data. We have developed a new method of creating an artificial pore structure of microfluidic chips that retains a large number of properties of the original core when moving from 3D to 2D structures. Moreover, using mineralogical data, we developed a model of heterogeneous wettability of void space in microfluidic chips to repeat the wettability in natural reservoir rocks. We assumed the model with hydrophobic macropore space and hydrophilic micropores because of the capillarity forces that retain water in smaller pores.

In conclusion, current research gave us complete information about mineralogy and the void space geometry of the core samples from the studied tight gas reservoirs. With these data, we could extrapolate future results of microfluidic tests to nearby tight gas sandstones with the same mineralogical composition.

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

Country

Russia

Porous Media & Biology Focused Abstracts

References

Conference Proceedings

I am interested in having my paper published in the proceedings.

Primary author: LATYPOVA, Margarita (LABADVANCE LLC, Lomonosov Moscow State University (Geological Faculty))

Co-authors: Mr CHEREMISIN, Alexey (Skolkovo Institute of Science and Technology, LABADVANCE LLC); PEREPONOV, Dmitrii (Skolkovo Institute of Science and Technology, LABADVANCE LLC); Mr BATYRSHIN, Eduard (RN-BashNIPIneft, LLC); Mr SHILOV, Evgeny (Skolkovo Institute of Science and Technology, LABADVANCE LLC); Mr MARYASEV, Igor (SMA (Systems for Microscopy and Analysis)); Mr TARKHOV, Michael (Institute of Nanotechnology of Microelectronics of the Russian Academy of Sciences); Mr MUKHIN, Roman (SMA (Systems for Microscopy and Analysis)); Mr NIGMATULLIN, Timur (RN-BashNIPIneft, LLC); Mr KAZAKU, Vitaly (Skolkovo Institute of Science and Technology, LABADVANCE LLC); Mr KOSORUKOV, Vladimir (Lomonosov Moscow State University (Geological Faculty)); Mr SHTINOV, Vladimir (RN-BashNIPIneft, LLC); SAMSONOV, Igor (Special Research Department, Field Development Division, ROSPAN INTERNATIONAL JSC)

Presenter: LATYPOVA, Margarita (LABADVANCE LLC, Lomonosov Moscow State University (Geological Faculty))

Session Classification: MS11

Track Classification: (MS11) Microfluidics and nanofluidics in porous systems