created by pore bodies, the second created by pore channels. It is possible with the use of fractal analysis of cumulative pore size distribution curves. Additionally, microscopic analyses give so called connectivity factor (number of pore channels joining single pore body with other ones). Such data, can be applied directly to Hagen - Pouisele formula.

Such procedure can be applied also for unconventional reservoir rocks like tight sandstone reservoir rocks. Even microporous sandstones have regular pore space which can be described using net model. Some problems may occur for carbonate tight rocks, because of space heterogeneity but generally it is still possible to apply this kind of model.

Situation change when we take into consideration shale reservoir rocks or coal rocks. These kind of rocks have nanoporous pore space. For pores lower than 100 nm model of fluids flow changes. Moreover, adsorption, capillary condensation and diffusion phenomena occurs. It is possible to perform fractal analyses for these rocks but its results show that range of pore radiuses 5 – 100 nm is characterized by two or three fractal numbers. This fact make impossible to applicate net model for such kind of pore space. Proof of application fractal analyses for part of pore space of such kind of rocks build by pores greater than 100 nm also fail because of inability to obtain unequivocal value of fractal number. Additionally, these rocks show great space heterogeneity so even for small number of samples for which we estimate fractal number connectivity factor change in very great range, not quite physical (for example 0.03).

Performed analyses showed that net model of pore space can be applied only to tight, regularly created rocks and more heterogeneous tight rocks has to be described using other flow models based on Knudsen diffusion and Darcy law.

ANALYSIS OF PORE SPACE OF SHALE ROCK USING MICROSCOPIC METHODS

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The paper presents comprehensive study of the Polish shale rock formation samples microstructure combined with mineralogy. Recently FIB/SEM technique, for pore space morphology and its 3D reconstruction, appeared as a method more and more frequently used by leading companies providing geological services. This work shows SEM and FIB/SEM data as a powerful tools for pore space extensive examination.

The permeability in shale rock depends on the existing pores and their mutual relationship and distribution of organic matter. Where mineral pores (interP) dominates pore network will be well connected. Continuous migrated organic matter with OM pores create well connected pore network.

For the description the pore space SEM (Qemscan) analyzes, FIBSEM and reconstruction the pore space (3D) were performed. The workflow applied in this study contain thin section (classic petrology) and mineralogical composition (Quemscan) analyzes. On the basis of these two analyzes regions to high resolution images (HRI) were selected. Based on HRI, FIB SEM 3D imaging was conducted. For each sample 2-4 HRI and 2-3 FIBSEM analyzes were performed.

In all samples a mixed pore network (Loucks et al., 2009) is dominant with the presence of interparticle pores (interP), intraparticle pores (intraP) and pores in organic matter (OM) (Loucks et al. 2009, 2012).

Intraparticle pores are located in clay agregates, in pyrite framboids between crystals of pyrite, dissolution-rim pores. Interparticle pores are located between grains and between clay platelets. Organic-Matter pore are located in organic matter. OM in shale rock are present as organic matter (depositional) and bitumen (migrates in mineral pores).The pores in the organic matter are formed in both in-place organic matter and in migrated organic matter. In OM pores distinguished sponge OM pore texture, bulb OM pore texture, fracture in bitumen and solid bitumen without pores. Migrated bitumen cemented mineral pores.