Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 125 (2017) 457–466

Energy Procedia

www.elsevier.com/locate/procedia

European Geosciences Union General Assembly 2017, EGU
Division Energy, Resources & Environment, ERE

CO_2 sorption of Pomeranian gas bearing shales – the effect of clay minerals

Marcin Lutyński[a,*], Patrycja Waszczuk[a], Piotr Słomski[b], Jacek Szczepański[b]

[a] *Silesian University of Technology, Faculty of Mining and Geology, ul. Akademicka 2, Gliwice 44-100, Poland*
[b] *Institute of Geological Sciences, University of Wrocław, ul. Maksa Borna 9, 50-204 Wrocław, Poland*

Abstract

The idea behind this study was to assess the sorption capacity of shale rocks as potential CO_2 storage sites. Thinly laminated mudrocks (gas bearing shales from Baltic Basin) with matrix composed mostly of illite, K-mica and chlorites and varying amount of organic matter were selected for the study. Results of sorption measurements up to the pressure of 15 MPa and at temperature of 50°C and 80°C were compared with XRD compositional analysis of samples and TOC values. Our experiments demonstrate that when organic matter is nearly absent in mudstones CO_2 sorption may also occur in clay minerals.

© 2017 The Authors. Published by Elsevier Ltd.
Peer-review under responsibility of the scientific committee of the European Geosciences Union (EGU) General Assembly 2017 – Division Energy, Resources and the Environment (ERE).

Keywords: CO_2 sorption; gas bearing shales; Total Organic Carbon; clay minerals;

1. Introduction

Depleting conventional gas reservoirs forced companies and operators for the search of other reservoirs where gas can be produced. Exploration of unconventional gas reservoirs such as *shale gas* and *tight gas* started the energetic revolution in the first decade of 21st century in USA and to the lesser extent also in Canada [1,2]. Most intensive exploration of shale gas and oil in Europe took place in the Lower Paleozoic Baltic-Podlasie-Lublin Basin in Poland [3,4]. The first shale gas exploration well in Poland was opened in 2010 and until the first quarter of 2017 over 70 exploration wells were drilled, including 16 horizontal wells [5]. The prospective shale formations are

* Corresponding author. Tel.: +48-32-2372487
*E-mail address:*marcin.lutynski@polsl.pl

1876-6102 © 2017 The Authors. Published by Elsevier Ltd.
Peer-review under responsibility of the scientific committee of the European Geosciences Union (EGU) General Assembly 2017 – Division Energy, Resources and the Environment (ERE).
10.1016/j.egypro.2017.08.153

spread over a large area of 37000 km^2 with depths ranging from about 2000 m to 5000 m [6,7]. The Lower Palaeozoic shale succession form ca. 700 km long belt extending from South Sweden, through Poland do Ukraine and resting on crustal basement of SW margin of the East European Craton (EEC) [8].

The European Union energy policy is focused on CO_2 emission reduction [9] and there is a strong need for finding alternative CO_2 storage places, particularly in countries where fossil fuels are a dominant source of energy. In Poland, where the vast majority of energy is generated from coal [10] the idea of Carbon Capture and Storage (CCS) could be a viable solution to reduce CO_2 emissions. Although different trapping mechanisms govern the CO_2 storage, the basic idea is to inject CO_2 and securely store it permanently underground. The option to inject CO_2 into deep underground traps could be extended to shale gas reservoirs [11–13]. In this case, CO_2 can be physically adsorbed on organic matter and/or clay minerals in the same way as methane. Recent studies show that not only organic matter contributes to the overall sorption capacity of shales but also clay minerals have a micro-porous structure which adsorbs gases and can enhance sorption [14–16]. This study explores the CO_2 sorption potential of shales as a function of their organic and mineral composition.

2. Materials and methods

2.1 Materials

For the study 4 samples with similar Total Organic Carbon (TOC) and varying by clay minerals content were chosen. Samples were all acquired from the exploratory borehole located in the Baltic Basin and represented Ordovician and Silurian mudstones from the depth interval of 3620 – 3720 m. The Baltic basin is considered as one of the Polish basins with the highest shale gas potential. The TOC content was measured by means of LECO apparatus at ACME labs. The TOC fall in the range between 0.98 – 4.19%wt. The mineral composition of samples was established with X-ray Powder Diffraction technique (XRD) at the Polish Academy of Sciences and the results of XRD analysis as well as TOC content are shown in Table 1. Three out of the four samples have very similar TOC content (0.98-1.3 %wt) whereas the fourth one has a considerably higher content of 4.19 %wt. The clay mineral content of samples is between 52.7 and 58.3 %.

Table 1 XRD analysis and TOC of samples.

Sample	1	2	3	4
Quartz. %	26.5	25.7	24.5	28.1
Kspar. %	1.3	1.3	1.1	1.5
Plagioclase. %	3.4	4	3.7	4
Calcite. %	6.2	3.7	3.3	1.9
Dolomite. %	2.2	1.6	1.6	0.1
Ankerite. %	3.2	2.7	1.8	0.5
Pyrite+Marcasite. %	4.2	2.7	2.8	2.5
Barite. %	0	0	0	0
Gypsum. %	0	0.4	0.3	0.2
Fe (oxy-) hydroxide. %	0.1	0.4	0.7	0.5
Apatite. %	0	0.4	0	0.2
Anatase. %	0.3	0.5	0.3	0
Kaolinite. %	0.7	1	0.5	0
2:1 Al Clay. %	44.6	48.4	49.3	52.2
Chlorite. %	7.4	6.4	8.5	5.5
Σ Clay. %	52.7	55.8	58.3	57.7
TOC. wt%	0.98	1.3	1.25	4.19

Download English Version:

https://daneshyari.com/en/article/5444942

Download Persian Version:

https://daneshyari.com/article/5444942

Daneshyari.com