

HRE031-20

会場:303

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多胡砂岩の層理面構造がCO₂流動に与える影響に関する岩石物理学的研究 The rock physical approach to the complex CO₂ flow in the bedded Tako sandstone

北村 圭吾^{1*}, 薛 自求¹, 山田 達也², 西澤 修¹
Keigo Kitamura^{1*}, Ziqiu Xue¹, Tatsuya Yamada², Osamu Nishizawa¹

¹ (財)地球環境産業技術研究機構, ² 京都大学大学院工学研究科
¹RITE, ²Kyoto University

In this study, we try to elucidate the effect of thin low-porosity layer in porous Tako sandstone on CO₂ flow by experimental and theoretical studies. Tako sandstone is early Miocene marine sandstone, mainly composed of quartz and plagioclase. This rock is characterized by the well-developed and low porosity foliations are mainly composed hematite. We have measured two channels of P-wave velocities (V_p) on the foliation channel (LPZ) and high porosity zone (HPZ) by using 1MHz P-wave transducers during CO₂ injection stage (drainage) and water re-injection stage (imbibition). In drainage, both of channels show large velocity reduction over 0.2 km/s (>10 %). In imbibition, they indicate different V_p-change with injecting water. The V_p of HPZ starts the V_p-recovery from 50ml injection and almost recovers at 120ml. On the other hands, LPZ starts V_p recovery from 100ml water injection and do not finish at 250ml. These results suggest that the HPZ has large CO₂ mobility and the LPZ has different CO₂ flow pattern between drainage and imbibition. Next, we try to 2D core-scale flow simulation by TOUGH-2 to check and discuss about CO₂ behavior in Tako sandstone. This simulation is based on 2-D porosity distribution map of core and uses relative permeability for parameters. The result of our simulation indicates that the foliation (LPZ) has large trapping potential of CO₂. The HPZ, which is directly beneath of foliation zone (DBFZ), has large CO₂ saturation in early stage of drainage. We confirm that CO₂ have large mobility and vigorous vertical flow in HPZ. After reaching upper foliation, CO₂ flows laterally along foliation and raise saturation of whole HPZ. In imbibition, CO₂ saturation of HPZ decreases rapidly to assign residual CO₂ saturation over 40ml water injection. However, DBFZ keep high CO₂ saturation after 100ml water injection. On the other hands, CO₂ saturation of LPZ is smaller than HPZ in drainage stage, but they show large saturation value over 20ml water injection. These results suggest that the foliation of Tako sandstone behaves as a barrier of CO₂ flow. It is implied that the thin low-porosity layer may be a barrier of CO₂ flow in porous saline aquifer.

キーワード: P 波速度, 片理面, CO₂ 流動パターン, 孔隙率分布, CO₂ 飽和度, TOUGH-2

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