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Preliminary simulation for the behavior of aqueous solution of carbon dioxide in abandoned coal mine

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In order to realize the scenario by the Ministry of the Environment to reduce 80% GHG emissions by 2050, even minor corporations which emit less than 108 kg-CO_2/year will have to implement CO_2 capture and storage. Therefore it is necessary to develop and prepare various ways of CO_2 storage to be adaptive to various geological conditions.

We conducted preliminary simulation for the behavior of aqueous solution of CO_2 injected by CMS (Carbon Dioxide Micro Bubble Storage) project. We particularly examine the case applying CMS to abandoned coal mine because the geological condition has been well investigated and relatively high porosity is expected around the past panels.For a case study, we developed a model for Shimizusawa coal mine in Yubari city, Hokkaido, Japan.

The simulated results from the standard model based on the range of existing data and practical injection rate showed that the aqueous solution of CO_2 was stored in the past panels. Even if we assumed the upper formations were as permeable as sandstones, aqueous solution of CO_2 was stored in the past panels. These results suggest the stability of CO_2 storage by the form of aqueous solution. On the other hand, if we assumed the thinner panels, aqueous solution of CO_2 did not spread well and aqueous solution of CO_2 reached the inclined access shaft. This result suggests that aqueous solution of CO_2 possibly flows to permeable pass preferentially to surface if the balance of reservoir condition and injection rate is not appropriate.

These results are expected to contribute to the design of CMS project or evaluation of solubility trapping.

Keywords: CO2 geological storage, CMS, aqueous solution of CO2, numerical simulation, abandoned coal mine