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Simple method to estimate maximum recoverable coalbed methane and carbon dioxide storage capacity from pure methane and carbon dioxide adsorption isotherms

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In order to reduce CO_2 emissions, it's necessary to save the energy, replace current fuels by lower carbon content one's and deploy renewable energy at larger scale. But these changes cannot be applied within a short period of time. We have to find therefore alternative solutions to decrease or at least stabilize CO_2 concentration in the atmosphere relatively quickly. One of these solutions is CO_2 capture and storage, especially for large and stationary CO_2 producers.

In this work, we are interested in CO_2 storage in unminable coal seams which consists of the injection of supercritical CO_2 into one or more suitable coal seams where it is stored mainly by adsorption onto the coal. Moreover this technique allows producing methane which is frequently occurring as natural adsorbed gas in coal seams. We speak then about enhanced coalbed methane recovery.

To estimate the methane which can be recovered and the carbon dioxide which can be stored in coal seams, we determined pure methane and carbon dioxide adsorption isotherms, with a gravimetric apparatus, at two temperatures (318 and 343K). These adsorption isotherms have been fitted by classic isotherm model. Thanks to these results, and mixture equations of state, we can determine the initial quantity of methane both in adsorbed and gaseous phase and the quantity of methane after depletion by reducing pressure of the reservoir. After, we determine the quantity of carbon dioxide

which can be stored and supplementary methane recoverable. Our results indicate that CO_2 injection allows producing more than 50% of methane remaining after coalbed methane recovery.