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DATE OF DISPUTATION:	12th of December 2016
DISSERTATION TITLE:	*Investigation of petrophysical and rock physical aspects of CO_2 storage in Sandstone reservoirs - An experimental study*

The effective stress coefficient for the permeability in sandstones has been found to be a function of the kaolinite clay content and this can be successfully modelled by the presented spherical Clay Shell Model. The relative permeability of CO2 in sandstones has been found to be relatively low due to domination of capillary forces over viscous forces and the mentioned phenomenon is most visible in case of gaseous CO2. The seismic response of CO2 saturated sandstones is strongly affected by the thermodynamic state of the CO2 inside the pore space and geophysical monitoring can be utilized for tracking the CO2 phase transition inside the storage reservoir.

Subsurface sequestration is one of the most agreed proposed solutions for mitigating the anthropogenic emissions of greenhouse gases like CO2. Among the considered geological traps for CO2, saline aquifers are of high interest due to their large storage capacity and availability upon the injection time.

In this PhD study the main focus has been to investigate the CO2 storage potential in the Knorringfjellet formation in Svalbard area that, recently considered as a potential site for a pilot CO2 sequestration project. In order to address the petrophysical aspects associated with CO2 storage a series of fluid flow experiments were conducted at the Department of Geosciences (UiO) and Norwegian geotechnical Institute (NGI) on the Knorringfjellet sandstone core plugs. The sensitivity of the core plugs to the applied confining stress and pore pressure in terms of the effective stress coefficient for the permeability (α_k) was studied and the dependency of α_k to the contrast between elastic moduli of quartz and clay minerals has been modelled. The modified Clay Shell model proposed in this study was successfully utilized to predict the α_k values by means of spherical pore geometry. The significantly low relative permeabilities of CO2 in the tested sandstones were attributed to inefficient sweeping of the in-situ water due to the domination of capillary forces over viscous forces, especially in case of gaseous CO2. The significant role of residual trapping in immobilization of a great portion of CO2, especially in the early stages of sequestration, has been experimentally documented.

Geophysical monitoring of the CO_2 plume movement inside the target aquifer is crucial for fully addressing the security issues associated with CO_2 leakage into the surrounding environment. The obtained results in the rock physics part suggest that the seismic response of the CO_2 saturated sandstone under different temperature and pressures, representing different CO_2 phases (gas, liquid, or supercritical), can be utilized for tracking the CO_2 phase transition inside the storage reservoirs.