DOCTORAL CANDIDATE:	Rohaldin Miri
DEGREE:	Philosophiae Doctor
FACULTY:	Faculty of Mathematics and Natural Sciences
DEPARTMENT:	Geosciences
AREA OF EXPERTISE:	Reservoir Modeling, CCS, Geoscience
SUPERVISORS:	Helge Hellevang, Per Aagaard, Magnus Wangen
DATE OF DISPUTATION:	December 4, 2015

DISSERTATION TITLE: *Effects of CO_2-Brine-Rock Interactions on CO2 Injectivity - Implications for CCS*

Carbon capture and storage (CCS) in geological reservoirs - especially saline aquifers - is a key midterm solution to mitigate climate changes caused by increasing anthropogenic CO_2. In order to ensure that a CCS project reach the required level of success, three essential elements need to be guaranteed; storage capacity, injectivity and containment. Among these elements, relatively less research has been conducted relevant to the injectivity, thus there are several technical uncertainties in this regard that should be understood and quantified in order to ensure long-term storage of CO_2. This thesis is therefore centered at improving such knowledge and understanding by addressing some of the vague research areas in regard to CO_2 injectivity including: CO_2/H_2O mutual solubilities, salt precipitation and depositional heterogeneities.

First part of this PhD study is devoted to thermodynamic modeling of fluid mixtures relevant for CO_2 storage with particular focus on effect of methane (CH_4) and sulphur dioxide (SO_2) impurities. To do this, a molecular based framework, Statistical Association Fluid Theory (SAFT) is chosen and the molecular parameters required by the model were adjusted against the available experimental data. The developed model is effectively used to predict phase partitioning, the aqueous phase density and water drop-out in contact with solid surface, which we believe to be especially well-suited to the assessment of injectivity of a proposed CO_2 storage reservoir.

In the next part of this study, the processes of drying-out and salting-out were explored in more detail. This work encompasses the fabrication of the two sets of glass microchips, as well as series of experimental characterization that has given us a valuable insight into the mechanism of salt precipitation. In particular, we have identified two mechanisms which together dramatically intensify the precipitation rate and amount of salt precipitated. From this insight, the reported discrepancies in the literature regarding the salt precipitation could be successfully explained and a new prototype for modeling of the process could be provided. We have also studied, but to a lesser extent, the effect of prepositional heterogeneities on the plume migration and pressure response at the injection well. We came to the conclusion that extreme well and aquifer pressures are unlikely for the setting studied in this thesis.

About the candidate:

Rohaldin Miri was born in 1984 in Khuzestan, Iran. He studied Reservoir Engineering at the Petroleum University of Technology (Iran). In 2010, he completed his master's degree in Reservoir Engineering at the Department of Chemical and Petroleum Engineering at University of Calgary, Canada. In 2012 he started his PhD studies at UiO, in the field of CO2 Sequestration. Contact information: rohaldin.miri@gmail.com