

**Rock-Fluid Chemical Interactions at Reservoir
Conditions: The Influence of Brine Chemistry,
Extent of Reaction and Mineralogy**

BENAI AH U. ANABARAONYE¹ JOHN P.
CRAWSHAW² J. P. MARTIN TRUSLER³

^{1,2,3} Qatar Carbonates and Carbon Storage Research Centre,
Department of Chemical Engineering, Imperial College
London, London SW7 2AZ, UK

¹b.anabaraonye13@imperial.ac.uk

²j.crawshaw@imperial.ac.uk

³m.trusler@imperial.ac.uk

Following carbon dioxide injection in deep saline aquifers, CO₂ dissolves in the formation brines forming acidic solutions that can subsequently react with host reservoir minerals, altering both porosity and permeability. The direction and rates of these reactions are influenced by several factors including properties that are associated with the brine system and mineral chemistry. Consequently, understanding and quantifying the impacts of the chemical and physical properties of the reacting fluids on overall reaction kinetics is fundamental to predicting the fate of the injected CO₂. In this work, we present a comprehensive experimental study of the kinetics of carbonate-mineral dissolution in different CO₂-acidified brine systems including sodium chloride, sodium bicarbonate and complex brines of varying ionic strengths. In addition, a set of well-characterized reservoir minerals with distinct chemical and physical properties were studied. Using a rotating disk technique, we have investigated the chemical interactions between the CO₂-saturated brines and carbonate minerals at conditions of pressure (up to 10 MPa) and temperature (up to 373 K) pertinent to carbon storage. The changes in surface textures due to dissolution reaction were studied by means of optical and electron microscopy and VSI. Experimental results are compared to previously derived models.