Wettability of Calcite Under Carbon Storage Conditions

Mihaela Stevar [C, S] and Martin Trusler
Qatar Carbonates and Carbon Storage Research Centre (QCCSRC), Department of Chemical Engineering, Imperial College London, London, United Kingdom
m.stevar@imperial.ac.uk

Carbon Capture and Storage (CCS) is essentially a three stage technology identified as one of the main options to mitigate the high levels of CO2 in the atmosphere, and is basically considered a potential bridging technology between fossil fuels and low carbon energy supplies in the global endeavour to tackle climate change. In carbon storage, interfacial properties are fundamental for accurate reservoir simulation as capillary pressure and relative permeability are strong functions of interfacial tension (IFT) and contact angle (CA), and these essential input parameters play a key role in determining storage capacity and security. Factors such as temperature, pressure, and concentration (i.e. for saline solutions and/or systems containing supercritical CO2) have significant effects on interfacial properties and thus affect the fluid flows and ultimately the effectiveness of carbon storage. Carbonate reservoirs present high interest for CO2 storage due to their vast storage capacities; therefore, the aim of this study is to attain a thorough understanding of their wettability at high-pressure, high-temperature (HPHT) conditions. Interfacial tensions between brine and CO2 have previously been measured at reservoir conditions and are fairly well understood. Consequently, in this experimental study, contact angles for the system CO2+ NaHCO3(aq) + calcite have been measured at HPHT conditions. The calcite is representative of limestone minerals and the brine chemistry and molality (1 mol/kg) has been chosen to inhibit dissolution reactions. In this way, contact angles under reaction-free conditions have been obtained as a first step before tackling calcite's reactivity. Both static (sessile drop) and dynamic (tilting plate) contact angle measurements were carried out at temperatures from (298 to 373) K and at pressures up to 30 MPa. The results obtained in this study will be presented together with the pathways that will be followed for extending this work.