Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Ion adsorption-induced wetting transition in oil-water-mineral systems BIJOYENDRA BERA, ANDREA CAVALLI, DIRK VAN DEN ENDE, FRIEDER MUGELE, Univ of Twente — The relative wettability of a rock substrate to oil and water is a central issue in many technological applications, especially in the field of enhanced oil recovery. We here consider a salty water droplet deposited on a mica substrate inside an oil bath. By adding specific ions to the water phase, a wetting transition can be induced. The water solution completely wet the mica substrate if it only contains monovalent cations (K^+ ,Na^+). However, when divalent (Ca^{2+} , Mg^{2+}) cations are added to the water phase, a finite contact angle (around 10^o) can be observed. We explain this phenomenon in the scope of a Poisson-Boltzmann model. The absorption of divalent ions at the mica interface generates a positive surface charge, and induces an attractive interaction to the negatively charged oil-water interface, which triggers the transition. We also observe that different cations can be arranged in an Hofmeister-like sequence, based on their effectiveness in changing the wettability of the mineral substrate. Finally, we show that adding small amounts of a polar surfactant to the oil phase synergistically enhances the wetting transition.

Andrea Cavalli
Univ of Twente

Date submitted: 06 Oct 2015 Electronic form version 1.4