Structure Analysis on Oil-Mineral Interface for Application to Enhanced Oil Recovery

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For the improvement of EOR, it is significant to grasp interfacial conditions, especially mineral/fluid interfacial properties (e.g. wettability), in reservoirs. The presence of acid or base compounds in crude oil and their interaction with solid surfaces are key factors in wettability alteration of solid surface [1]. The purpose of this study is to understand the structure of a mineral/acid-oil interface by X-ray Crystal Truncation Rod (CTR) measurement, which is one of the X-ray structure analysis methods. Disturbance of the crystal periodicity induced by adsorbed layers at the crystal surface can be caught as a CTR signal, and it is generally weaker than that of the other methods [2]. This method provides the electron density profile normal to the interface which reflects the interfacial structure.

In this study, we conducted the X-ray CTR measurements at SPring-8 for the muscovite-oleic acid system before and after the NaCl brine (1.0 wt%) flooding, and tried to grasp the change of static conditions of the interface. Muscovite is a mineral, which can provide clean and fresh plane (i. e. cleavage (001) plane), and oleic acid is a fatty acid, which is a carboxylic acid with a long unsaturated straight chain. The muscovite (001) plane is negatively charged compensated with pottasium ions. Therefore, in this system, it is estimated that oleic acids initialy adsorb on the muscovite surface due to cationic bridging. The obtained CTR signals to both before and after the flooding well reflect the periodicity of muscovite crystal. Furthermore, the oscillation is observed in the CTR signal before the flooding, but it is lost after the flooding. This indicates that the oleic acid molecule is perpendicularly adsorbed to the muscovite surface before the flooding, but it is removed after the flooding. This finding is consistent with previous experimental work for powdered samples, where it was shown that the presense of water reduces the adsorption of fatty acid on muscovite [1].

[1] Gomari K. A. R., Denoyel, R., Hamouda, A. A. (2006) *J. Colloid Interface Sci.* **297**, 470-479. [2] Fenter P. A. (2002) *Reviews in Mineralogy and Geochemistry* **49**, 149-221.