Reconciling potentiometric titration and Second Harmonic Generation measured diffuse layer potential of an aqueous silica suspension

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The mineral surface potential plays a significant role in the quantitative understanding of mineral dissolution, contaminant transport and mineral colloid stability yet generally is not directly accessible experimentally. In particular, for most mineral surfaces of interest there are thought to be (at least) two relevant surface potentials: that of the mineral surface (ϕ_β and/or ϕ_0) and, some distance into the aqueous phase, a diffuse layer potential (ϕ_d). Surface potential is generally determined using electrokinetic techniques. However, these methods require hydrodynamic perturbation of the system and necessitate employing a model with difficult to constrain parameters to calculate $\phi_0/\phi_\beta/\phi_d$.

Second Harmonic Generation (SHG) is a second order nonlinear optical process, driven by an intense laser source, which is sensitive to interfacial electrical fields. For this reason the variation in the intensity of measured SHG (I_{SHG}) with changes in pH (for systems where H^+ is the sole potential determining ion) and salt concentration has previously been used to describe the surface potential of a variety of noncrystalline organic materials in water, as well as to determine the pH_{pzc} of several mineral/water systems. Here we measure the I_{SHG} for the colloid silica/water system as a function of salt concentration at a variety of pH and use the results, in tandem with potentiometric titration, to quantify the mineral surface potential as a function of solution chemistry.

Origin and application of GOI data of oil inclusions in structurally complex Junggar Basin (NW China)

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GOI (grains containing/with oil inclusions) data are commonly used to identify paleo-oil columns and to map original oil-water contacts in hydrocarbon reservoirs. However, in superimposed China's basins, oil-water contacts mostly have changed for variable times due to complex tectonic evolution. Thus, those threshold lines suggested in previous literatures, such as 1% for water zone and 5% for oil zone, can still be used effectively?

The Junggar Basin is one of the typical tectonically complex but most prolific oil provinces in China. In this study, five typical wells with different oil and gas shows were selected for GOI analyses in the Mosuowan area, central Junggar Basin. Discussion on analytical results from 48 reservoir samples indicates that the GOI data were mostly decided by intensity of reservoir hydrocarbon charging. However, due to the complex petroleum charge histories in superimposed basins, it is suggested that we should not simply use the GOI data to define petroleum migration according to previous threshold lines (e.g., 1%, 5%). It is more probable that based on geologic background, firstly to discuss the origin of GOI composition and then to have an application in reservoir characterization.

The case study in the Mosuowan area of the central Junggar Basin infers three specific points. Firstly, a GOI value of less than 1% was not always indicative of water zone or only migration of oil, but possible of gas reservoir or dysmigration of hydrocarbons. Secondly, the GOI values below 5% were still likely to indicate expose to high oil saturation when considering the difficulty in capture of oil inclusions in places. Thirdly and lastly, the threshold line of 6% GOI was likely the criterion for migration of industrial hydrocarbon reserves in the study area.

In a word, GOI method is still effective in quantitative evaluation of petroleum migration in structurally complex basins, but should be used comprehensively in combination with geologic background.

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