Spectral induced polarization of Na-montmorillonite dispersions

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Introduction

Montmorillonite has remarkable adsorption properties because of its high specific surface area and surface charge density. Its surface charge distribution is also anisotropic. The basal faces have a negative and permanent surface charge due to isomorphic substitutions in the crystal and the edge faces have a pH-dependent surface charge due to amphoteric surface sites. We propose low-frequency complex impedance measurements of Na-Mt dispersions in the unexplored frequency range [Hz kHz] to get information on surface charge distribution, size and shape of Na-Mt dispersions at various particles concentrations (weight fractions 0.5 to 5%), salinities (from 10^{-4} to 10^{-2} M NaCl), and pH (5 to 10).

Experiment and results

Complex impedance measurements were performed using a cylindrical sample holder of length 30 cm, diameter 1 cm, two brass electrodes at the top and bottom of the sample holder for current injection, two brass electrodes for electric potential measurement, and the spectral induced polarization (SIP) apparatus developped by Zimmermann *et al*. [1]. The maximum instrument accuracy is a phase shift between injected current and measured electrical potential difference of 0.1 mrad. Electrochemical polarization of the electrical double layer around Mt aggregates was observed [2]. Dielectric permittivity spectra were inverted to obtain relaxation time and aggregate size distributions using the inversion code developped by Weigand and Kemna [3]. Depending on particles weight fractions and water chemical composition, changes of the surface electrical properties, size and shape of Mt aggregates were observed.

[1] Zimmermann *et al*. (2008) *Meas. Sci. Technology* **19**, 1-9. [2] Arroyo *et al*. (2000) *J. Colloid Interface Sci*. **229**, 118-122. [3] Weigand and Kemna (2016) *Comp. & Geo*. **86**, 34-45.