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Mechanisms behind Induced Polarization Effects in Water and Brines Confined in Clay Minerals Oriented Films

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The dynamic behavior of water molecules in soils has been extensively studied throughout the years and the understanding of the diffusion processes that occur are of primary importance especially when it comes to waste manage- ment. The main goal of this master project is to study how water molecules confined in clay minerals are moving regarding to salinity and how an electric field stimulation affects the diffusion processes. For the purpose of this study samples of hydrated montmorillonite and beidellite (clay minerals and more specifically smectites) with different salt concentrations were analysed using quasi elastic neutron scattering at the time of flight spectrometer AMATERAS (J-PARC, Japan). A first superficial analysis of the data showed that both the application of electric field as well as the addition of salt indeed affect the diffusion of the water molecules. More specifically, an increase in the mobility is observed when electric field is applied, while on the other hand the presence of salt concentrations indicated a slowing down in the mobility of the water molecules in the sample. In order to analyze the smectite data, the analysis of previous samples of bulk-water using quasi elastic neutron scattering at the backscattering spectrometer IRIS (ISIS, UK) was needed in order to com- prehend the already used data analysis methods, i.e. Swingi-Schölander and minimal model as well as to confirm the correlation between the application of different approaches. After analysing all the data sets, a next step for sam- ples treatment will be to apply Thermogravimetric Analysis to determine the thermal stability and Infrared Spectroscopy to get insight into how interlayer salt and external electrical field may influence structural components of the clay mineral.

Field of study

Physics of Complex Systems

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