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Characterizing the Diffused Double Layer Properties of Clay Minerals

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Abstract : The difference in characteristic behavior of clay minerals for different electrolyte solution is dictated by the corresponding variation occurring at its diffused double layer thickness (DDL). The diffused double layer of clay mineral has two distinct regions; the inner region is termed as 'Stern layer' where ions are strongly attached to the clay surface. In the outer region, the ions are not strongly bonded with the clay surface, and this region is termed as 'diffuse layer'. Within the diffuse layer, there is a plane that forms a boundary between the moving ions and the ions attached to the clay surface, which is termed as slipping or shear plane, and the potential of this plane is defined as zeta potential (ζ). Therefore, the variation in diffused double layer properties of clay mineral for different electrolyte solutions can be modeled if the corresponding variation in surface charge, surface potential, and zeta potential are computed. In view of this, the present study has attempted to characterize the diffused double layer properties of three different clay minerals interacting with different pore fluids by measuring the corresponding variation in surface charge, surface potential, and zeta potential. Further, the obtained variation in the diffused double layer property is compared with the Gouy-Chapman model, which is the widely accepted theoretical model to characterize the diffused double layer properties of clay minerals.

Keywords : DDL, surface charge, surface potential, zeta potential
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