Hydraulic and Electrical Flows in Clays

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Abstract: The electrical conductivity of saturated kaolinite clay-water-electrolyte systems of different particle size distributions and of illite and montmorillonite clays were determined over the frequency range of $50 - 10^8$ c/s. The conductivity increases as the frequency increases, and the experimental values show two distinct dispersions, one in the low frequency range and the other in the high frequency range. The frequency range over which the first dispersion occurs is experimentally shown to be dependent on particle size. The average particle size is uniquely related to the frequency at which half the dispersion occurs. The magnitude of conductivity variation, the high frequency conductivity and the streaming potential values are related to the microscopic permeability coefficient. This microscopic permeability coefficient, evaluated from a knowledge of the above electrical properties, is shown to be uniquely related to the Darcy permeability coefficient at various consolidation states of the kaolinite clays. Similar unique relationships have been observed in illitic clays.

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