APPLICATION OF MEMBRAME POLARIZATION FOR STUDYING INTERNAL STRUCTURE OF ROCKS

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Mathematical modeling of a little known model of IP referred to as “induced polarization caused by constrictivity of pores” was developed. Polarization occurs in all types of rocks if surface areas and transfer numbers are different for connected pores. During the polarization process all contacts between pores of different transfer numbers will be blocked and the electrical current will flow through the remaining canals. During time-on a voltage is created due to flowing current and excess concentration at the contacts. However during the time-off only the excess of concentration is involved in the diffusion process which tends to level the ion concentration along the pores. It was shown that the measured chargeability is proportional to porosity. Blockage of pores and gained/loss of ions at the contacted pores control this physical parameter. However the relationship between resistivity and porosity is more complicated than this. Mathematical modeling and laboratory measurements both confirmed the membrane IP effect diminishing with increasing salinity of fluid filled pores of rocks. Mathematical modelling of the process of current flow in several samples confirmed the proposed model. These samples are shale, shale with dropped stones, mudstone, tillite, hematite, lava and manganese ore. The “product” of this stage of work is the pore size distribution in the sample, anisotropy and relative amount of pores able to transport ions. It was shown that the size (pore radii) of pore can be different even when the porosity of the samples is the same. The dominated radii of investigated samples varied from 10 μm up to 1 μm. Mathematical modeling of membrane polarization effect can provide reliable information of pores space of rocks, their dynamic porosity and permeability and transportation, especially of contaminant compounds.

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