PERMEABILITY OF THE WET SAND

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The air permeability of the unconsolidated porous media wetted with liquid was experimental studied. It was shown, at small Reinolds numbers the gas permeability coefficient K_G of wetted media is greater than of dry one at the same gas saturation. The observation complements certain well-known suggestions.

Flow of gases in porous media wetted with fluids plays an important role in many sciences and engineering field. In nature it is of vital importance in solid geospheres (degassing of Crust and Mantle, recycling in subduction process, mineralization, gas and oil migration in reservoir rocks and so on) interaction of laters with hydrosphere (e.g., in ocean-floor spreading zones), biota (on a differents levels) and with atmosphere (e.g.,through volcanic eruption, by emanation from soil and permafrost). Owing to its complexity, the phenomenon has been studied by and large, through direct experimentation. Numerical simulations have been largely confined to geometrically simplified ordered system and low flow strength.

From many evidences, it is believed that because of restriction of free space and requirement of barbotage in viscouse liquid the fluid in porous space give a supplementary resistence to gase flow.

The aim of the work is the further study of the influence of wetting liquid′s amount on gas permeability in unconsolidated porous media at small Reinolds nubers (Re).

The quartz sand was took as a model of unconsolidated media. The grains of this sand are rather rounded, their dominant size is about 0.25 - 0.35 mm. The sand was washed and then dried at temperature abowe 100°C before usage.

The specimens were prepared by adding a known amount of water to fixed mass of the sand. The composition was carefully mixed to obtain a homogeneous substance. Such procedure conduct to satisfactory reproducibility of the results.

The permeabilty was measured at the unidimensional steady state flow in Darcy region. The experiments were conducted in the cylindric tubes with uprising air stream. The flow rate was measured by means of rotameter. The pressure was measured by water manometer. The flow rate per specimen end face area was of order of 0.01 m/s. Pressure gradient was c.a. 10 Pa/m and $Re \leq 0.1 \div 1$.

The partial water saturation was varied from 5 to 70 % of dry sand porous space. There was a phenomenon of upward motion of water at saturation abowe 40 % and sufficient high air stream. The water was imbibed in to the bottom of a column of the sand. The latter behave the features of consolidated porous media with a fracture network. The gas and water flow essentially through created fissures with unstedy state character and barbotage typicall for two-phase sistems. The separates bubles of air near the fractures and tube wall are observed. The flooding was followed by sudden and irreproducible changes of permeabilty of specimen. The water goes down from the upper surface if the air supplay is turned off.

The suspension and flooding were not observed below 40% of water saturation. The water behave as a resdual liquid. The gas flow was in the steady state. Under this conditions K_G of wetted sand is greater by 40 –50 % than of dry one at same porosity. At water saturation below about 20% the K_G nor stay unchanged by addition of water, bat even augment. This may attribuated to change of mechanism of gase sliding and rising of hydraulic diameter of channels. The latter has a maximum in hexagonal packing model of identical spheres.