Paper ID: 44591
oral

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Fluid and Materials Sciences (2)

Author: Ms. Evgeniya Skryleva
Lomonosov Moscow State University, Russian Federation, jennyne@yandex.ru

Dr. Vladislav Dushin
Lomonosov Moscow State University, Russian Federation, ebifsun1@mech.math.msu.su

MICROGRAVITY INVESTIGATION OF CAPILLARY FORCES IN IMBIBITION OF FLUID INTO POROUS MEDIA

Abstract

The capillary driven filtration in porous media under microgravity conditions is investigated. Effect of capillary forces and the type of wettability of the medium on the displacement process is studied.

Experiments on the imbibition of liquids into a porous medium under the influence of capillary forces under microgravity are considered. Liquid seepage was observed in three-sample cylinders with the same porous medium. The fluids moving in each of the three cells were: crude oil, lubricating oil and polymer in distilled water.

On the basis of these experiments, constants were selected for a new mathematical model that allows taking into account the blurring of the front that develops due to the displacement instability. As a result, of numerical modeling on the basis of the obtained mathematical model, the flows under the effect of a combination of capillary forces and a constant pressure drop or a constant flux were studied. It was shown that the capillary effects play significant role only when the external pressure gradient is small enough as compared with capillary forces, otherwise the capillary factor can be neglected. The dimensionless criterion characterizing the ratio of forced and capillary driven convection was introduced in order to find out in which case the capillary effects are insignificant and can be neglected.

Russian basic research foundation (project code 17-08-01032) is acknowledged for financial support.