Paper ID: 85626
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IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Fluid and Materials Sciences (2)

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STUDY OF SEEPAGE FLOWS IN POROUS MEDIA UNDER MICROGRAVITY AND TERRESTRIAL GRAVITY CONDITIONS.

Abstract

The behavior of liquids in microgravity is significantly different from the behavior in terrestrial conditions. In the absence of terrestrial gravity, capillary pressure becomes the main driving force. Studies of the flow of liquids due to capillary forces are very relevant for space technologies. For example, on board the space station, the supply of liquid from a reservoir (for example, fuel) is possible only due to capillary forces. Also, capillary effects play an important role in the movement of fluids in heat pipes of spacecraft thermal control systems. This report discusses experiments on imbibition of a porous medium during parabolic flights. The results of processing experiments when the flow occurred in a porous medium formed by glass balls are presented. Mathematical models describing such a process are proposed. The results of numerical simulation are compared with experimental data. The paper also presents the results of experiments on flow through a porous medium formed by glass balls inside a Hele-Shaw cell under terrestrial conditions. The Hele-Shaw cell is a thin channel between two plates that is often used to observe the behavior of liquids in microgravity. The experimental results are also compared with the results of mathematical modeling. Carrying out such studies will allow for more accurate predictive modeling of processes occurring in the absence of gravity, and will also be useful in the preparation of new space experiments. The authors wish to acknowledge the support by Russian Science Foundation (Grant initiative 21-71-10023).