Two-layer flow of the electrolyte-dielectice system under ac electric field

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introduction

The electroosmosis microflow of two layers dielectric-electrolyte system in AC external electric field is scrutinized. Such a system is commonly used for transportation of dielectric liquids in microscales. The electroosmotic motion of the electrolyte, induced by an external electric field, imply the motion of the liquid dielectric through the interface [1]. For the practical issues, application of AC electric field is more profitable, because it allows to avoid the undesirable chemical reactions [2].

Mathematical model

The two-phase microflow of conductive (electrolyte) and nonconductive (dielectric) viscous liquids bounded by two charged solid walls in external AC electric field is scrutinized. An interface between two liquids is assumed to be a free surface. The electrolyte behavior is described by the Nernst-Plank-Poisson-Stockes system of equations for the ions concentrations, electric field and velocity field; the behavior of dielectric field is given by the Poisson-Stockes system of equations for electric potential and velocity field. The stress-balance boundary condition is applied on the interface. The solid surfaces are assumed to be impermeable to cations and anions, and the electric potential is fixed here. An external electric field directed along the channel.

Results and Discussion

The one-dimensional solution, which corresponds to the flow with unperturbed interface, is founded out. Its linear stability is investigated. This study based on the Floquet theory for discretization of the system in time, and on the Galerkin method – for discretization in space. The dependences of the critical absolute value of the electric field intension on frequency and other parameters of the system are obtained. It is found that the one-dimensional flow is stabilized with frequency magnification.

The work is supported, in part, by the Russian Foundation for Basic Research (project No 15-08-02483-a)\_.

*References*

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