Investigation of electrolyte near nonideal ionselective surfaces

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Introduction

The work is dedicated to investigation of electrolyte behavior near and inside the imperfect membranes. As it has been shown in the latest research [1, 2], the consideration of imperfectly selective membranes is what allows to discover the new types of instability, such as equilibrium instability and instability within the Ohmic current regimes.

Mathematical model

The three-layer system electrolyte-membrane-electrolyte is scrutinized, and the behavior in all the areas is described by the Nernst-Plank-Poisson-Stockes system of equations. The distinction for the membrane area consists in existence of the space charge of membrane and absence of electrolyte movement. Also, the chemical reactions of water dissociation can take place inside the membrane. The latter plays a crucial role for the investigation of the bipolar membranes [3], because of high intensity of electric field in the junction between two oppositely charged membranes, which intensifies the water dissociation processes due to the second Wien effect.

Results and Discussion

The consideration of imperfect monopolar membranes allowed to detect a new type of instability – oscillatory instability for the membranes with a small charge or for the electrolytes with a high concentration of salt [4]. For the bipolar membranes, the one dimensional solution was found numerically and the presence of overlimiting current regime was detected. Such a regime arises due to the second Wien effect, water dissociation processes and the catalytic reactions with the ionic groups of membrane.

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