

An EHD Effect of Silicone Oil with Normal Alcohol Additives due to Asymmetric Space Charge Polarization

Kyoko Yatsuzuka, Shunsuke Shimoyama

Yamagata University, 4-3-16 Jonan, Yonezawa
Yamagata-ken 992-8510, Japan

Abstract:

We have investigated on the fundamental characteristics of an electrohydrodynamic (EHD) effect with the doped silicone oil using a cylindrical-cylindrical electrode system under a DC electric field to clarify the mechanism. Even symmetrical electric field distribution there is a significant EHD effect. In previous paper one of or both electrodes are coated with insulating substance in order to control the rate of the electrochemical reaction and then a model considering the local permittivity distribution due to the space charge polarization is proposed. The body force acting on liquid with carriers under the electric field is written as three terms; Coulomb force, gradient force of permittivity, gradient force of electric field squared. The first term is the force act to the true charge, and the others are electrostriction force. Most of investigators have ignored the second term because the permittivity of liquid was considered constant. The local permittivity at DC or very low frequency the space charge polarization should be taken account. In this report five normal alcohols are used as additives. Normalizing the carrier number density from molecular mass and the mobilities from literature the model we proposed was roughly confirmed.