

The wetting behavior of hydrocarbon liquids on water with accounting for water solubility

Kirill A. Emelyanenko*, Alexandre M. Emelyanenko, Ludmila B. Boinovich,

A.N. Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Leninsky prospect 31 bldg. 4, 119071 Moscow, Russia;

e-mail: emelyanenko.kirill@gmail.com

The wetting behavior of hydrocarbon liquids on water is analysed on the basis of the isotherm of disjoining pressure. It is shown that an important contribution to temporal variation of wettability of water surface originates from the solubility of water in hydrocarbon liquids. The equations for the distribution of electric potential inside the oil wetting film are derived within the Debye–Hückel approximation, taking into account the polarization of the film boundaries by discrete charges at water-oil interface and by the dipoles of water molecules dissolved in the film. On the basis of above equations we estimate the image charge contribution to the surface forces, excess free energy, isotherms of water adsorption in oil film and the total isotherms of disjoining pressure in hydrocarbon film. The results indicate the nonmonotonic variation of contact angle formed by oil droplet on aqueous surface with time, associated with kinetics of water solubility in oil.