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Ion Induced Hydrophilicity at Hexane Vapor Water Interface

SHANSHAN YANG, YUDAN SU, CHUANSHAN TIAN, Fudan University, STATE KEY LABORATORY OF SURFACE PHYSICS, DEPARTMENT OF PHYSICS, FUDAN UNIVERSITY TEAM — How ions occupy themselves at hydrophobic interface plays a key role in physical, chemical, atmospheric, and biological processes. However, hydrophobic molecules often gather together on water surface, thus few experiment taking on the adsorption of hydrophobic molecules on aqueous solutions from vapor phase. In this work, we report unexpected mutually promoted adsorption of hydrophobic molecules and ions through unification of contact angle method and sum frequency vibrational spectroscopy (SFVS). We observe oil tends to spread on solutions with higher pH, implying interaction exists between hydrophobic molecules and ions. SFVS suggests that this phenomenon stems from relatively strong Coulomb interaction between hydrophobic molecule and hydroxide ions, the initial hydroxide ion adsorption free energy is calculated. The surface charge density induced at the interface is plotted to show the variation of surface charge density with both hydroxide ion molar fraction and hexane vapor pressure. In addition, we propose a new perspective on explanation of intensity decay of icelike band at high pH (>10) aqueous solution\hydrophobic interfaces, in which the relative relation between Debye length and coherence length plays an essential role.

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