Charged Colloids at the Metal–Electrolyte Interface

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The peculiarities of the structure of the interface between a metal and a stable colloidal dispersion of charged nanoparticles in an electrolyte are discussed. It is demonstrated that a quasi-2D ionic structure of elevated density arises in its vicinity due to the effect of electrostatic image forces. The stabilized colloidal particles, being electroneutral and spatially distributed objects in the bulk of the electrolyte and approaching the interface, are attracted to it. In their turn, the counterions forming their coat partially retract into the 2D-layer, which results in an acquisition by the colloidal particle of the effective charge eZ^* >> e and which, together with its mirror image, creates the electric dipole. The formed dipoles, possessing the moments directed perpendicularly to the interface, form the gas with repulsion between particles. The intensity of this repulsion, evidently, depends on the value of the effective charge eZ^* acquired by the nanoparticle having lost a number of counterions. It can be related to the value of the excess osmotic pressure Posm measured in the experiment. On the other hand, this effective charge can be connected by means of the simple geometric consideration with the structural charge eZ of the nanoparticle core being in the bulk of the electrolyte.