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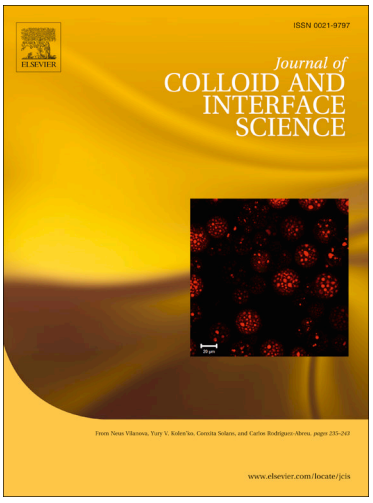

Flexibility of inactive electrokinetic layer at charged solid-liquid interface in response to bulk ion concentration

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Flexibility of inactive electrokinetic layer at charged solid-liquid interface in response to bulk ion concentration

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ABSTRACT: It has been a long-lasting debate on the position of zeta potential plane within aqueous solutions. This paper reports a flexible behavior of the inactive electrokinetic layer between the outer-Helmholtz plane and zeta potential plane, so-called buffer layer, in response to bulk ion concentration. This flexibility is not only corroborated by analyzing the measured zeta potentials with resulting electrical quad-layer model (inner- and outer-Helmholtz, buffer, and diffuse layers) but also consistent with thermodynamic analysis. The model indicates that the flexible buffer layer thickness saturates to its minimum for concentrated solutions. The predicted ionic conductance agrees well with the previous experimental measurements in nanochannels. The theory provides a deep physical insight into understanding, design, and manipulation of ion transport in nanosystems.

KEYWORDS: Zeta potential plane; inactive electrokinetic layer; electrical quad-layer model; ionic conductivity; narrow nanochannels

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