

TOWARDS UNDERSTANDING THE IMPACT OF SURFACE MATERIAL PROPERTIES ON CONFINED IL BEHAVIOR

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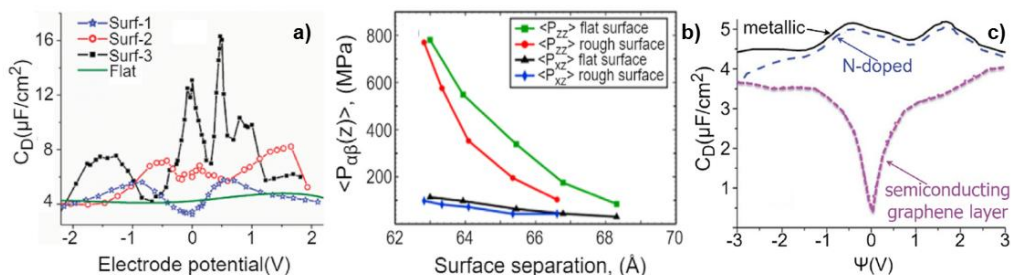
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Recent advancements in ionic liquid (IL) research are driven by their application as electrolytes in various technological applications due to their specific and tunable properties. Special attention is attributed to IL behavior in the confinement because of phenomena such as overscreening and the superionic state. To understand the mechanisms governing confined IL behavior, current research mainly examines the role of IL properties, while the impact of confining material properties is not less important.

We have analyzed recent theoretical and simulation findings, which reveal the contribution of substrate material properties and suggest possible extensions required to improve our understanding in this field (see Figure). Particularly, we cover the impact of surface morphology and multiscale nanoporous geometry on the capacitance properties of confined IL and ion diffusion. Then we provide a literature background on mechanical properties and deformation for the system of confined IL between two surfaces. Additionally, we addressed the influence of confining material chemical composition on confined IL properties, covering ionophobicity, polarizability, and quantum capacitance issues [1]. Overall, this work emphasizes the critical role of surface material properties in confined IL research and identifies key gaps for future investigation.



a) Differential capacitance variation near electrodes with different structures, b) Stress tensor components for flat and rough confinement, c) the impact of the chemical composition of the confining surface on the differential capacitance profile

1. Nesterova I. et al. The role of surface material properties on the behavior of ionic liquids in nanoconfinement: A critical review and perspective of theory and simulations //Advances in Colloid and Interface Science. – 2025. – P. 103623.