Asymmetric selectivity of synthetic conical nanopores probed by reversal potential measurements

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The study of rectifying systems like conical nanopores demands an extension of our understanding of ionic selectivity. The asymmetric conduction shown by these pores is connected to the idea of directionality: the rates of ionic transport and the charge regulation exerted by the system are nonsymmetrical. As a result, ionic selectivity is not only a property of the nanopore itself but also depends crucially on the direction of the concentration gradient. Previous studies of current-voltage curves provide an adequate description of the conductive properties of the system but give only indirect clues about how charge regulation is performed. In this sense, the study of the reversal potential offers additional and essential information. To this end, here we present a model for reversal potential in conical nanopores based on the Poisson and Nernst-Planck (PNP) equations. The theoretical results are compared with experimental data, and good agreement is found using only one fitting parameter, the surface charge density, which is determined independent of the current-voltage characteristics.