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Poisson-Nernst-Planck model of ion current rectification through a nanofluidic diode DRAGOS CONSTANTIN, ZUZANNA SIWY, University of California, Irvine — We have investigated ion current rectification properties of a recently prepared bipolar nanofluidic diode. This device is based on a single conically shaped nanopore in a polymer film whose pore walls contain a sharp boundary between positively and negatively charged regions. A semiquantitative model that employs Poisson and Nernst-Planck equations predicts current-voltage curves as well as ionic concentrations and electric potential distributions in this system. We show that under certain conditions the rectification degree, defined as a ratio of currents recorded at the same voltage but opposite polarities, can reach values of over 1000 at a voltage range (-2V, +2V). The role of thickness and position of the transition zone on the ion current rectification is discussed as well. We also show that the rectification degree scales with the applied voltage.

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