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Probing diffusion on the nanometer scale using electrochemistry DIEGO KRAPF, MENG-YUE WU, HENNY W. ZANDBERGEN, CEES DEKKER, SERGE G. LEMAY, Kavli Institute of Nanoscience, Delft University of Technology, The Netherlands — Studying ion diffusion in liquid at the nanometer scale is experimentally very challenging. We report on an electrochemical approach to this problem: an electrode of nanometer dimensions is immersed in solution and biased so as to drive an electron transfer reaction with an ionic species in solution. The electrical current through the electrode provides a direct measure of the diffusive flux of ions to the electrode surface. Because the concentration gradient is localized in the immediate vicinity of the nanoelectrode, this provides very local information and high concentration gradients can be achieved. To carry out these experiments, we have recently developed a method for fabricating nanoelectrodes with a well-defined size and geometry. A pore is first drilled in an insulating membrane with a focused electron beam and it is then filled from one side using a noble metal. Conical electrodes as small as 1 nm in size are obtained. Measurements of the diffusive flux at such nanoelectrodes will be presented and their implications for ion diffusion on the nanometer scale will be discussed.

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