Self-consistent calculations of the ionic current traces of a nanoparticle translocating through a nanopore

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We computationally study the ionic current traces arising when a nanoparticle permeates through a nanopore and compare them with experimental observations. Brownian dynamics is utilized to describe the random motion of a particle through the nanopore with electric and hydrodynamic forces acting on the particle calculated self-consistently for different particle positions in the nanopore. We consider the motion of an uncharged particle which translocates along the direction of the electroosmotic flow. With an applied bias of 100 mV, the hydrodynamic force is the dominant force in this case, and it results in an enhanced drag acting on the nanoparticle in the nanopore and its vicinity. The electric force which accounts for the dielectrophoretic effects is noticeable only near the entrance and exit of the pore. Our simulated current traces reveal similar features observed in experimental results.