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Electro-Induced Dewetting and Concomitant Ionic Current Avalanche in Nanopores XIKAI JIANG, Clemson Univ, JINGSONG HUANG, BOBBY SUMPTER, Oak Ridge National Laboratory, RUI QIAO, Clemson University — Electrically driven ionic transport of room-temperature ionic liquids (RTILs) through nanopores is studied by molecular dynamics simulations. It is observed that a gradual dewetting transition occurs in nanopores originally wetted by RTILs if the applied voltage is increased, and meanwhile the ionic current through the system increases sharply. These phenomena originate from the solvent-free nature of RTILs in which the ions' mobility increases sharply when their concentration decreases and are contrary to the transport of conventional electrolytes through nanopores. The results also show that the amplification of ionic current is possible by manipulating the properties of the nanopore and RTILs and is especially pronounced in charged nanopores. The results highlight the unique physics of nonequilibrium transport of RTILs in confined geometries and point to potential experimental approaches for manipulating ionic transport in nanopores, which can benefit diverse techniques including nanofluidic circuitry and nanopore analytics.

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