

Abstract Submitted
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Nanopore Mass Spectrometry¹ JOSEPH BUSH, MIRNA MIHOVILOVIC, WILLIAM MAULBETSCH, LAYNE FRENCHETTE, WOYOUNG MOON, COLE PRUITT, Brown University Physics Department, CARTHENE BAZEMORE-WALKER, PETER WEBER, Brown University Chemistry Department, DEREK STEIN, Brown University Physics Department — We report on the design, construction, and characterization of a nanopore-based ion source for mass spectrometry. Our goal is to field-extract ions directly from solution into the high vacuum to enable unit collection efficiency and temporal resolution of sequential ion emissions for DNA sequencing. The ion source features a capillary whose tip, measuring tens to hundreds of nanometers in inner diameter, is situated in the vacuum ~ 1.5 cm away from an extractor electrode. The capillary was filled with conductive solution and voltage-biased relative to the extractor. Applied voltages of hundreds of volts extracted tens to hundreds of nA of current from the tip. A mass analysis of the extracted ions showed primarily singly charged clusters comprising the cation or anion solvated by several solvent molecules. Our interpretation of these results, based on the works of Taylor and of de la Mora, is that the applied electric stresses distort the fluid meniscus into a Taylor cone, where electric fields reach $\sim 1\text{V/nm}$ and induce significant ion evaporation. Accordingly, the abundances of extracted ionic clusters resemble a Boltzmann distribution.

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