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A Universal AC Cone Angle due to Net Entrainment of Anionic Species NISHANT CHETWANI, SIDDHARTH MAHESHWARI, HSUEH-CHIA CHANG, University of Notre Dame — The slender conical meniscus that is obtained by the application of high frequency AC field is quite distinct from DC Taylor cone. The AC cone shows continuous longitudinal growth and has a much smaller half cone angle of $\sim 11^\circ$. Mass spectrometry on the microjet from the AC cone shows that dissociation reaction occurs at the tip but only the low-mobility anionic species are entrained to produce a charged cone. These free negative charges relax to the interface to produce a non-uniform surface charge density that scales with respect to the azimuthal radius as $\rho^{-\frac{1}{2}}$ to balance the singular normal capillary pressure. Repulsion of this entrained surface charge and the Maxwell pressure they induce are estimated with an elliptic integral and a variational formulation produces a normal stress balance with capillary pressure that is only satisfied at a universal angle of 12.6° for the liquids with high dielectric constant, in good agreement with the measured values for the organic solvents used in experiments.

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