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Ambient Air Humidity Affects the Charge Acquired by Water Drops in Oil KRISTEN FAWOLE, WILLIAM RISTENPART, University of California Davis — A water drop in an insulating fluid acquires charge when it contacts an electrode, but experimental measurements of the charge acquired by the drop have been hindered by irreproducibility, charge asymmetry ($q_+ \neq q_-$), and time-dependence. Previous work, dating back to Maxwell in 1892, has implicitly assumed that the effect of external environmental conditions is negligible during the charging process of water droplets. Contrary to that assumption, we report that charge accumulation on the experimental apparatus itself increases with increasing ambient humidity in the presence of applied high voltages (> 3 kV). Additionally, using dissimilar metals for connecting the high voltage source to the electrode magnifies charging effects in high humidities. A scaling analysis indicates the surface charge of the apparatus is much larger than the ostensible surface charge on the electrode due to the applied field. The humidity-dependent charge accumulation provides a possible explanation for the difficulties in quantitatively corroborating Maxwell's prediction for the charging dynamics of droplets contacting a planar electrode.

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