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Electrohydrodynamic conduction pump – An experimental investigation

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Electrohydrodynamic pumps (EHD) were built and tested to further understand the nature of the technology. Two pumps built used a conductive pumping action to achieve flow within a dielectric fluid. The first pump (pump 11) had a spacing of 1.27 mm between electrode pairs while the second pump (pump 12) had a spacing of 3.05 mm between electrode pairs; each pump had nine electrode pairs, three pairs per channel in three parallel channels. Each pump allowed for testing at the single electrode configuration, three electrode series in a single channel, and three channels working together in parallel. Comparisons could be drawn between the two pumps to test what effect the electrode spacing had on reliability, fluid flow, and efficiency. For pump 11, three electrodes in series worked better than expected. For example, working against 26.4 Pa of hydrostatic pressure, three electrodes working in series produced a flow rate of 0.1189 mL/s, while the average for a single electrode at 26.4 Pa was 0.0209 mL/s; a factor of 5.69 increase. This was not the case for pump 12. Under the same circumstances three electrodes in series had a flow rate of 0.0681 mL/s while the single electrode average was 0.0303 mL/s; a factor of 2.25 increase. Between the two pumps there was not any detectable difference in reliability. The same design had been previously tested; those tests were plagued by bubbles forming within the pumps and carbon buildups around the electrodes. This thesis details the construction of the pumps, the equipment setup used to test the pumps, testing procedure, and an interpretation of results.