Characterization of Thrust Generated in an Electrohydrodynamic Spinner

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***Abstract*— Sharp metal pins were used to design a spinner based on the torque that can be created by the induced electrohydrodynamic (EHD) flow around the pins when high voltage is applied. Six pairs of sharp pins were attached to an insulator circular frame (6 cm radius) using copper tape. The spinner was suspended on a needle tip inside a grounded semitransparent metal frame. Upon the application of high voltage (up to +39 kV) the circular frame would spin and a maximum/terminal velocity would be achieved for a constant applied voltage. The motion of the spinner, from start to maximum speed for a certain voltage applied, was recorded using a Photron high-speed camera. Spinner frequencies measured from camera footage were combined with physical and geometrical specifications of the device for the extraction of the thrust. A maximum of 455 rpm was obtained at 39 kV for a spinner mass of 7.84 g. A quadratic dependence of the thrust on the applied voltage was observed. Terminal velocity varies almost linearly with the applied voltage (15kV to 39 kV). The present characterization of the spinner may be useful in improving the design of EHD thrusters.**