

Experimental characterization of EHD thrust from pin emitters

Adrian Ieta*, Justin D'Antonio, Marius Chirita, Bibash Kc
State University of New York at Oswego
e-mail: adrian.ieta@gmail.com

Abstract — EHD thrust is intensively studied in static setups. The conversion of electrical power into mechanical airflow (EHD thrust) for propulsion is known to have high efficiency. Our study aims at characterizing the thrust and its dependence on control parameters that can be used for optimization in practical applications. Studying the EHD thrust-induced rotation of pin emitters spinners may offer significant advantages in assessing the thrust properties relative to static setups. In a symmetric rotational setup, the EHD thrust is extracted from the dynamics of the thrust-induced rotational motion. Sensitive testing of the influence of the polarity of the pin emitters, pin density, or pin geometry, are rather simple to perform. The study of the terminal velocity of the EHD spinner (the maximum speed at which the drag compensates the EHD torque) shows a linear dependence with the applied voltage but only within a limited range starting at the corona wind onset. Outside the region the speed drops or shows oscillations before increases again with the applied voltage. The terminal velocity (and EHD thrust) generated at negative voltages is slightly but consistently larger than values for positive polarity. The increase in the terminal velocity per kV is larger for the small radius ring electrode than for the large radius ring.