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Ion-neutral momentum transfer efficiency in ionic wind devices.[1]
NICOLAS MONROLIN, OLIVIER PRAUD, FRANCK PLOURABOUE, Institut de Mecanique des Fluides de Toulouse (IMFT), Universite de Toulouse, CNRS, INPT, UPS, France — The ion-neutral momentum transfer occuring in an ionic wind device is investigated. By measuring the airflow velocity using Particle Image Velocimetry (PIV), the local force and so the ion flux, including the pressure gradient is retrieved. By considering various electrodes configurations, our investigation brings out the physical origin of previously obtained optimal configurations, associated with a better trade-off between ion-neutral forcing, viscous friction occurring at the collector(s), and aerodynmic wake interactions. Comparing the net electro-hydrodynamic (EHD) thrust to previous mesurements with digital scales, it is shown that the contribution of velocity fluctuations in the wake of the collecting electrode(s) must be taken into account to recover the net thrust from airflow measurements. By using the charge conservation properties in the drift region of the corona discharge, a general theoretical derivation of the EHD forcing is derived, based on the current/mobility ratio and the electrode geometry. Finally an estimation of the averaged charge carrier mobility based on PIV measurements is developped.

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