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Measurements of Thrust and Flow Velocity of Plasma Discharge on Dielectric Surface

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Abstract : This research presents investigations of Dielectric Barrier Discharge (DBD) (Plasma Actuators), experimental methods used to calculate the induced body force for three types of dielectrics (PMMA, HDPE and Teflon) were used as plasma Actuators with two type's electrodes (Copper and Aluminum). The measurements of the thrust were produced which is then associated with a control volume analysis on data obtained by using laser Doppler anemometry (LDA) method. For the direct measurements, the influence of variable the actuator types which the induced flow acts is also investigated. The results from these tests showed that the dielectric type is most effective at higher voltages with the measured force increasing.

The PMMA dielectric was found to have a strong influence on thrust generation as compared to the other dielectrics tested. However, the power supplied to actuator manifests itself primarily as heat generation with no noticeable thrust measured.

PMMA plasma actuator has good flow velocity up to 24 m/s at 1mm dielectric thickness. The actuator thrust was higher, approximately up to 54 mN/m with copper electrodes at 9kV AC applied voltage and 8kHz frequency in 2mm dielectric thickness.

Keyword : plasma actuator, flow velocity, discharge plasma, thrust of plasma actuators.

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