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Optical Diagnostics of Air Flows Induced in Surface Dielectric Barrier Discharge Plasma Actuator TAKUYA KOBATAKE, MASANORI DEGUCHI, JUNYA SUZUKI, KOJI ERIGUCHI, KOUICHI ONO, Kyoto University — A surface dielectric barrier discharge (SDBD) plasma actuator has recently been intensively studied for the flow control over airfoils and turbine blades in the fields of aerospace and aeromechanics. It consists of two electrodes placed on both sides of the dielectric, where one is a top powered electrode exposed to the air, and the other is a bottom grounded electrode encapsulated with an insulator. The unidirectional gas flow along the dielectric surfaces is induced by the electrohydrodynamic (EHD) body force. It is known that the thinner the exposed electrode, the greater the momentum transfer to the air is [1], indicating that the thickness of the plasma is important. To analyze plasma profiles and air flows induced in the SDBD plasma actuator, we performed time-resolved and -integrated optical emission and schlieren imaging of the side view of the SDBD plasma actuator in atmospheric air. We applied a high voltage bipolar pulse (4–8 kV, 1–10 kHz) between electrodes. Experimental results indicated that the spatial extent of the plasma is much smaller than that of the induced flows. Experimental results further indicated that in the positive-going phase, a thin and long plasma is generated, where the optical emission is weak and uniform; on the other hand, in the negative-going phase, a thick and short plasma is generated, where a strong optical emission is observed near the top electrode.

[1] C. L. Enloe *et al.*, AIAA Journal, Vol. 42, 2004, pp. 595–604.

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