Abstract Submitted for the GEC05 Meeting of The American Physical Society

Surface dielectric barrier discharges as actuators for flow control Y. LAGMICH, G. HAGELAAR, L.C. PITCHFORD, J.P. BOEUF, CPAT, CNRS and Univ P Sabatier, Toulouse, France — Surface discharges created in Dielectric Barrier Discharge (DBD) configurations have been proposed as actuators for flow control in aerodynamic applications. Using a two-dimensional model of the surface dielectric barrier discharge in pure nitrogen we study the time evolution of the plasma and calculate the electrohydrodynamic force acting on the gas flow. The results show that this force is due to the momentum transfer from the ions to the neutral molecules in the sheath that propagates along the dielectric layer surface. The calculations also confirm that the asymmetry of the electrode configuration is responsible for the existence of a non-zero averaged force parallel to the surface. We present a parametric study of the discharge and calculated electrohydrodynamic force as a function of geometry and applied voltage. We also discuss the possible effect of photoemission from the dielectric surface on the discharge properties. Finally, the discharge model is coupled to the Navier Stokes equations for the gas flow to evaluate the effect of the surface discharge on the boundary layer.

Leanne Pitchford CNRS, France

Date submitted: 13 Jun 2005 Electronic form version 1.4