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Flow separation control by plasma actuator with nanosecond pulse discharge ANDREI STARIKOVSKII, Drexel University, DMIRTY ROUPASSOV, Moscow Institute of Physics and Technology, ANDREI NIKIPELOV, NEQLab Research, MARYIA NUDNOVA, Moscow Institute of Physics and Technology — Boundary layer separation control by plasma actuator with high-voltage pulsed periodic nanosecond excitation is presented. Actuator-induced gas velocities show near-zero values for nanosecond pulses. The measurements performed have shown overheating of discharge region at fast ($\tau \approx 1$ μs) thermalization of the plasma imputed energy. The mean values of such heating for the plasma layer can reach 70, 200 and even 400 K for 7, 12 and 50 ns pulse duration, respectively. The emerging shock wave together with the secondary vortex flows disturbs the main flow. The resulting pulsed-periodic disturbance causes an efficient transversal momentum transfer into the boundary layer and further flow attachment to the airfoil surface. Thus for pulsed nanosecond periodic DBD the main mechanism of impact is the energy transfer and heating the near-surface gas layer. The following pulse-periodic vortex movement stimulates redistribution of the main flow momentum. The experiments have shown high efficiency of the given mechanism to control boundary layer separation, lift and drag force coefficients, and acoustic noise reduction in the Mach number range of 0.05 to 0.85.

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