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Three-Dimensional Simulations of Surface Air Plasma Discharge Phenomena SHANKAR MAHADEVAN, LAXMINARAYAN RAJA, The University of Texas at Austin — Computational simulations of air plasma discharges are presented. The glow discharge model is based on a self-consistent continuum description of the plasma. A finite-rate air chemistry model with 11 species is used to model air plasma at pressures $\sim$1-20 Torr typical of plasma actuator operating conditions for high-speed flow control applications. Practical limitations on the grid size and number of species in the chemistry model motivate the need for the development of parallel plasma models. The parallelized model is used to study physical structure and chemical composition of a surface direct-current glow discharge with circular pin electrodes. The three-dimensional structure of the discharge is captured by the model. For a discharge current of 25 mA, the peak plasma density is found above the cathode covering the entire cathode surface with a spot attachment at the anode. The plasma is electronegative with the O^- ion density about three times higher than the electron density. In general, qualitative agreement is found between the three-dimensional and corresponding two-dimensional simulations for the same operating parameters. The peak gas temperature from the computations is found to be about 1000 K in the three-dimensional case and 1180 K in the two-dimensional simulation.

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