The pulse polarity influence on the atmospheric pressure plasma jet

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We use a two-dimensional self-consistent fluid model to study the characteristics of the atmospheric pressure plasma jets under different polarities.Power was employed in the form of a trapezoidal +7kV and -7kV pulses with 10ns rise time,a 10ns fall time.A neutral gas transport model was employed to predict the concentration distribution of helium and ambient air in the system.There were then used in a plasma dynamics model to investigate the characteristic of the plasma jet during its propagation between the tube exit and the mental electrode.For both of the polarities,the discharge first propagated as a surface wave along the inner surface of the containing tube,and then excited the tube with a tabular structure.For the two jets,the velocity of the ionization wave first increase in the vicinity of the ring electrode,and then decrease with the increment of the distance to the ring electrode.It was found that the propagation velocity for the negative ionization wave was higher than that for the positive one in the tube.After exiting the tube,due to the mixing of the ambient air,the velocity of the both polarities increasing first and then decreasing during the further spread because the increasing of the volume ionization due to the Panning ionization and the changing of the permittivity.But during the further spread,the velocity of both polarities decreasing may be due to the electric field.Simulations have shown that the positive jet can reach longer position than the negative jet after a certain distance.A reverse electric field developed during the falling edge of the pulse,which accelerated electrons forming a brief backward discharge,with forming a secondary streamer in the tube.The electron temperature of the positive jet increases under the energy electrode,but it is opposite to the head of the jet.We don’t find the similar phenomenon in the negative jet.