ANGULAR DISTRIBUTION OF IONS GENERATED BY NANOSECOND SURFACE FLASHOVER OF POLYMERS

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In this work we measured angular distributions of ion part of plasma beams generated by surface flashover of PTFE, PMMA, and polyethylene. We used nanosecond pulse generator with stored energy of 2 J, output voltage of 90 kV, and current pulse duration of 30 ns. The discharge unit has a linear electrode geometry with a 20-mm gap. The ion current of the plasma flow was registered by a Faraday cup positioned in two mutually perpendicular planes. We used permanent magnets to separate plasma electrons and suppress the secondary electron emission in Faraday cup caused by collisions of ions with collector. Magnetic field was transverse to the plasma flow motion. Faraday cup moved along arc with 60 cm radius (distance from discharge) by steps 15 degrees. The angular distributions of ion charge for all materials have an axial asymmetry which is typical for the spatial distribution of particulate mass [1]. The angular distributions of average ion velocity are also axially asymmetric but not similar. The directional patterns of ion velocities in the plane perpendicular to the sample surface and in which a discharge path lies are almost the same for all three materials, whereas the patterns in the plane normal to the discharge path differ noticeably. We show that for PTFE samples the average ion velocity demonstrates a slow linear decrease from 110 to 100 km/s as the angle changes from 0 to 75 degrees, respectively. By contrast, the ion velocities for PMMA and polyethylene in the normal direction are lower than for the others growing almost linearly from 150 km/s for the normal direction to 180 km/s for angle of 60 degrees. Besides, angular distribution of ions flow hydrocarbons in the initial moments of time is more widely than at maximum. This may be due to the fact that light particles (hydrogen) come off earlier than there is a rupture of C–C bonds inside the chain.

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