MAGNETIC CONTROL OF MPD ACCELERATOR JET PARAMETERS

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Abstract

The problems of control of the plasma jet emitted by the magnitoplasmadynamic accelerator are investigated. Designs of deflecting, scattering, focusing or rotating magnetic systems are described. Experimental results on magnetic control of plasma jet are given. The effect of efflux regimes on the efficiency of magnetic control of plasma jet is investigated.

Introduction

At present the sources of high velocity flows of the charged and neutral particles are widely used in the technology, many areas of industry, cosmonautics and also to solve various technological problems. The magnetoplasmadynamic accelerator (MPDA) [1] is one of most perspective sources, it was repeatedly tested both on land and in the space environment [2-4]. This accelerator has a series of unique properties, which permit it to have a considerably more wider extensive field of application in comparison with other sources of low temperature plasma. In particular, it can work in three regimes of plasma efflux, when the jet is quasi-neutral, and it has excess of positive and negative charges [5]. The field of MPDA application can be considerably expanded if you use the controlling magnetic system (CMS). They permit to deflect, scatter, focus or rotate the deflected plasma jet, change its charge.

The present report deals with the problems of focusing, scattering and rotation of MPDA plasma jet using two controlling plasma systems.

Controlling Magnetic Systems

A usual current coil was used to focus or scatter the plasma jet. When currents in the coil and the accelerator solenoid are matched, i. e. when they have the same direction, the jet is being focused. In case directions of current are not matched, the plasma jet scattering occurs. In experiments on HPDA plasma and focusing a coil was used of 85 mm mean diameter, having 2000 windings of copper wire of 0.33 mm diameter.

With 27 V feeding voltage the magnetic induction in the center of the coil was of the order of 15 mT. The coil resistance was about 100 Ω. The coil was positioned at 90 mm from the accelerator anode exit.

The second version of CMS allows deflection or rotation of the plasma jet. The system comprises four solenoids positioned diametrically. Coil with cores made from steel Э12 of 8 mm diameter and 22 mm length were used in the experiments as solenoids. The core formers had 1200 windings, the inner diameter being 10 mm and outer diameter being 24 mm. The coils were fastened on diametrically opposite ends of the bracket having magnetic insulation. The controlling magnetic system used allows the plasma jet to be deflected in any direction when diametrically opposite solenoids are switched on by currents of adequate magnitudes and directions [6]. When solenoids, which are positioned

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