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# Laser-Beam Polarization and Lateral Extension of Ions of a Plasma Torch

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As was established earlier, when a powerful laser radiation acts on a solid the evaporated material is ejected mainly along the normal to the surface of an obstacle independently of the angle of incidence of laser beam on it [ 1]. The most energetic ions and electrons are scattered in this direction too [ 1,2]. However, as was shown in our previous works, at scattering angles close to 90°, i.e., in the case that plasma extends along the obstacle surface, the energy spectra of ions with different charges broaden newly to the region of high energies [3,4]. We found out that the laws of lateral laser plasma extension and mechanism of forming of the ion energy spectra are determined by the conduction properties of the plasma-forming target. On the other hand, as was revealed, the lateral extension of a plasma torch and its energetic ions is much dependent on the polarization characteristics of the incident laser radiation and, specifically, on the type of polarization and its orientation.

In this work we present results of investigation of the mechanism of the lateral extension of a plasma torch, formed by the action of a plane-polarized laser radiation ($\lambda$ = 1,06 μm, t = 25 nsec) on a conducting obstacle. The experimental setup is presented on the fig. 1.

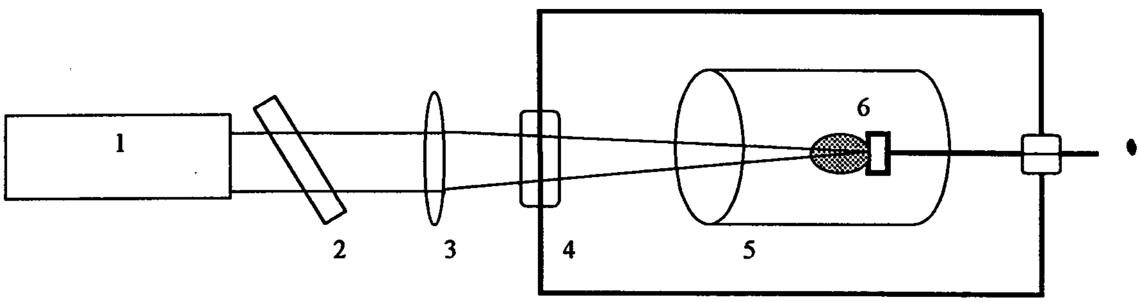


*Fig. I Experimental setup*

*1 – Nd-laser, 2 – polarizator, 3 -focusing lens, 4 – vacuum chamber, 5 – copper cylinder, 6 - target*

The laser beam flux density on the target was 10" W/cm$^2$. Experiments were made in a vacuum at a pressure of ~ $10^{-5}$ Torr. Laser radiation fell to the target surface at 90°. The angle pattern of the plasma torch extension to a hemisphere towards the laser beam was investigated through studying the precipitation of the evaporated target material on the inside walls of a copper cylinder 20 mm in diameter. The cylinder surrounded the target on all sides and was arranged in line with it. The obtained results can be formulated as follows (see fig.2).

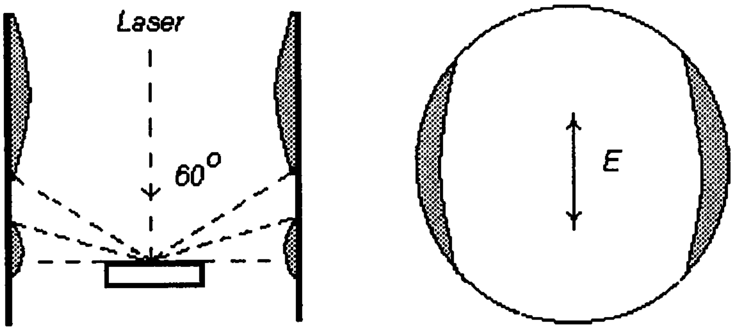


*Fig.2 Scheme of deposited layers*

There are two different regions in the layer deposited inside the cylinder. The first region is the region of a uniform deposition. It is located in the angle range of a = 0-60°. Then in the angle range of a = 60-85° there is a light zone, in which the deposition, if ever occurs, is very small.' And then in the angle interval of $a$ = 85-90° the deposited layer appears again, the deposition is nonuniform in density and depends on the laser radiation polarization plane orientation. In the direction perpendicular to the laser radiation polarization plane the deposition was very intensive, and in the direction coincident with the polarization plane the deposition was practically absent. If the laser beam wasn't polarized the deposition in the near-surface region (a = 85-90°) was uniform.

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References

1. N.G.Basow, V.A.Boyko, V.A.Dementev ets., JETP, 1966, vol.51(4), p.988
2. Y.A.Bykovski, N.N.Degtyarenko, V.F.Elesin ets., JETF, 1971, vol.54(4), p.1306
3. L.I.Kiselevski, V.V.Shkurko Izvestia AN BSSR, 1984, vol.1, p.41
4. I.A.Dmitriev, L.I.Kiselevski, V.V.Shkurko J.of Appl.Spectr., 1988, vol.48(6), p.909