

INTERFEROMETRY OF PLASMA FOCUS DISCHARGE AT 2 MA

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The plasma focus facilities are simple and effective sources of fast ions [1]. Visualization of the column at the time of ion acceleration was performed on the PF-1000 device operating in the IPPLM Warsaw at the deuterium filling at the current of 2 MA and the neutron yield above 10^{11} [2]. The visible interferometry and time resolved x-ray and neutron detectors were used as the diagnostic tools. 16 interferograms from one shot showed the plasma transformations during 200 ns. At this current above Pease-Braginski limit the spherical-like, helical and toroidal structures were imaged. For example, the toroidal rings or helical collars around the imploded current sheath were recognized in each shot. Their absorption inside the plasma column induced existence of axial component of magnetic field at stagnation. Some of these structures were relative stable for tens and sometimes hundreds of nanoseconds and transform with the Alfvén velocity (a few times of 10^7 cm/s). The time of HXR and neutron emission correlated with three types of transformations. Two of them, the transformation of the dense ellipsoid into the sphere, and formation of regions with low plasma density in the column center were realized by the Alfvén velocity. The third type, i.e. explosion of the dense spheres at the constriction development, was realized by the velocity above 10^8 cm/s. Dynamics of transformation is interpreted by evolution of internal magnetic structures realized by spontaneous and fast reconnection [3].

[1] A. Soto et al., "Experimental Studies of the Plasma Focus and Evidence for Nonthermal Processes", *Phys. Fluids* vol.18, 1975, pp. 180-194.

[2] P. Kubes, M. Paduch, T. Piszarczyk, M. Scholz, T. Chodukowski, D. Klir, J. Kravarik, K. Rezac, I. Ivanova-Stanik, L. Karpinski, K. Tomaszewski, E. Zielinska: Transformation of the Pinched Column at the Time of Neutron Production, *IEEE Transactions on Plasma Science*, Vol. 38, 2010, in print.

[3] P.Bellan, *Fundamentals of Plasma Physics*, Cambridge University Press, 2006.

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