NUMERICAL SIMULATION OF PLASMA DYNAMICS at NONCYLINDRICAL Z-PINCH FACILITIES

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The report is about evolution of plasma-current sheath (PCS) of plasma focus discharge. It shows numerical simulated PCS evolution in the PF-3 with different gases and gas mixtures. The results was obtained with one-component magnetic hydrodynamic model with Hall effect supplemented [1]. The Hall effect is taken into account in the thin layer over anode. paragraph.

PSC moving to the facility’s axis due to “magnetic piston” that is magnetic sweeping gas and results to z-pinch formation. The simulation shows that magnetic piston is a dominant mechanism for current sheath moving – except heavy gases (>4 a.m.u.) at radius 40 cm and less. In this case Hall effect is more significant.

The simulation shows that the maximum gas compression is not at same time as current derivative minimum. Derivative’s peak is earlier than maximum compression. This phenomena is more significant for light gases. For heavy gases (Ar, Ne) it’s not observably because of Hall effect accelerates compression phase.

Presented simulation is in agreement with experiments for heavy gases (Ne, Ar) as well as light ones (H, D) and gas mixture (0,97D + 0,03Xe). So we built the universal model of PCS moving in PF-3 facility for differet gases and mixtures.

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References

1. S.S. Ananyev, S.V. Suslin, Fusion Engineering and Design, 2018, Volume 137, Pages 338–348.