A NEUTRONIC SYNTHESIS OF PROTON – BORON IN A COMPACT SCHEME OF INERTIAL ELECTROSTATIC CONFINEMENT (IEC)

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Previously, in the IEC scheme [1,2] based on a nanosecond vacuum discharge (NVD) of low energy, DD synthesis have been demonstrated experimentally [3,4]. This paper presents the first experimental results on aneutronic proton-boron synthesis in the field of a virtual cathode in NVD, and further simulation of all related processes within the full electrodynamic code KARAT [4a]. Earlier, modeling revealed the key role of the formation of a virtual cathode (VC) and the corresponding potential well (PW) in the interelectrode space of NVD [3,4]. The formation of a deep quasi-stationary PW provides in the interelectrode space both confinement and acceleration of protons and deuterons to energies of tens of keV, and multiply charged boron ions up to hundreds of keV. It turns NVD into a kind of microreactor of collisional nuclear synthesis [4]. In principle, this also includes aneutronic synthesis for exotic fuels like D - He3 or p - 11В. In particular, the proton - boron reaction is accompanied by the release of only three fast alpha particles (р + 11В. → α + 8Be∗ → 3α + 8.7 MeV) and has great fundamental and applied interest [5, 6]. In this experiment, as before, in the cylindrical geometry of the NVD, a new hollow cathode with slits along the axis have been used, which made it possible to register the yield of α-particles both along the discharge axis and radially. Boron was applied onto anode Pd tubes with a developed surface microrelief using cataphoresis in aqueous suspension of boron nano powder, and at the same time Pd tubes were saturated with hydrogen by electrolysis. As a result, when the voltage is applied (100–120 kV), the irradiation of the surface of specially prepared Pd tubes by auto electrons from cathode provides erosion anodic plasma with protons and boron ions. Further, acceleration and head-on collisions of protons and boron ions with energies of the order of 100–300 keV (at the center of mass) during their oscillations in PW lead to a p + 11В reaction with a noticeable yield of α - particles. The CR-39 detectors registered reliably the excess of the α-particle yield over the background (five times) both along the axis and along the discharge radius. Further work have to show the efficiency of the scheme chosen as a possible basis for miniature reactor of aneutronic proton-boron synthesis [2].

References

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