PRODUCTION OF THE ACCELERATED IONS UP TO MEV-ORDER IN THE AXISYMMETRICALLY-CONTRACTED DIVERGENT Z-PINCH PLASMA

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The particle acceleration up to 250 keV (electrons) was observed in the divergent gas-puff z pinch experiments with the 25 kV charged voltage of capacitors[1]. The main trigger of the acceleration may be attributed to the fact that the spatial distribution of the initial media (injected gas) had been inclined axially just like a plasma focus device. This is because the more compressed hot spots could have been produced locally near the constricted side of the initial gas distribution. In order to explain the acceleration mechanism of 250-keV electrons indirectly, we measured the energies of the accelerated ions in the divergent gas-puff z pinch with the Thomson parabola ion analyzer. The divergent z-pinch experiments were carried out with the SHOTGUN-I device at Nihon University in Japan.

Parabola tracks of accelerated ions depend on species, velocities and energies of ions. Because of the poor resolution, the ion valence numbers and exact species were still not determined from this study. The highest energy of accelerated ions of each parabola was calculated to be MeV-order in case of the possible elements (argon as filling gas or carbon as the electrode material). Obtained parabolas were divided into two sets with tracks on the constant-energy line and ones on the constant-velocity line. The difference of the distribution could reflect the acceleration mechanisms. The ions on the constant-energy line may be accelerated by the pulsed inductive electromotive force and the ones on the constant-velocity line may be accelerated by the shockwave. The m=0 instability in the contracting process of divergent z-pinch plasma could induce both of two mechanisms.

1. K. Takasugi and E. Kiuchi, "Hard X-Ray Radiation from a Z-Pinch with a Divergent Gas-Puff", Plasma Fusion Res. Rapid Commun., Vol. 2, 036. (2007)