

Mitigation of spontaneous rotation of field-reversed configuration by using magnetized plasmoid injection

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FRC (Field Reversed Configuration) is one of the magnetic confinement systems so-called “compact torus” and has unique features as extremely high beta, natural diverter, linear device geometry and central structure. Therefore FRC potentially has been candidate as an advanced fusion reactor system[1]. Although FRC has these attractive advantages, there are still remaining the problems to realize the FRC reactor. Especially lifetime of FRC has been severely restricted by destructive instability so-called rotational instability with toroidal mode number of $n = 2$.

A rotational instability raises an elliptic deformation of toroidal cross section, and the deformation quickly grows by spontaneous toroidal rotation of FRC. Some suppression methods for the elliptic deformation have been investigated by experimental and numerical studies. The application of multi-pole magnetic field has been well-known suppressing technique for the elliptic deformation and has succeeded in suppressing the deformation[2]. However, its non-axisymmetric magnetic component severely degrades the confinement of FRC. In this presentation, we proposed a new control method for the rotational instability by using double sided magnetized plasmoid injection technique. In this technique, two magnetized plasmoids have spheromak like magnetic configuration, two operation modes were available; poloidal and toroidal flux injection and poloidal flux injection.

Suppression of the elliptic deformation was observed in both cases, and poloidal flux injection case showed more effective suppression effects: rotation period was prolonged by 7 μ s (145% extension) and growth rate was reduced to 30 % of no-injection case. Furthermore, reduction of angular frequency was observed in injection cases.

In conclusion, the newly control technique for rotational instability of FRC has been developed. The proposed technique successfully mitigated the spontaneous spin-up of FRC by magnetized plasmoids injection, and the elliptic deformation was suppressed as a result of the mitigation of FRC's rotation.

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