

Dynamo Effect in the Reversed Field Pinch Plasma

Formed by a Self-Reversal Method

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Reversed field pinch (RFP) is one of the plasma confinement systems for a nuclear fusion research, which can be categorized into the toroidal current-carrying system. In the RFP configuration, the high temperature and the high density plasma can be confined by the relatively weak magnetic field with due to the dynamo effect. Here, the dynamo effect is one of the self-organization phenomena for the plasma, the earth, the sun and so on. The most part of the magnetic field is generated by this dynamo effect in the RFP plasma. However, since the dynamo effect is caused by the MHD fluctuations, loss of energy and particles by the fluctuation becomes a serious problem. Therefore, the understanding of the dynamo effect is most important subject for the physics of the RFP plasma and the improvement of the confinement.

There are two methods for the formation of the RFP plasma. One is the “added-reversal mode (AR method)”, and another is the “self-reversal mode (SR method)”. In the formation of the RFP plasma by using the AR method, the toroidal magnetic field is reversed enforcedly by an external circuit. The RFP plasma has the good plasma confinement, but it is difficult to investigate and understand the process of the magnetic field reversal with the dynamo effect. In the formation of the RFP plasma by using the SR method, the toroidal magnetic field is reversed spontaneously by the dynamo effect. Although the RFP plasma has the poor plasma confinement, the dynamo physics can be possible to understand.

In this experiment, the formation of the RFP plasma is succeeded by both SR and AR methods. The discharge property of both RFP plasmas is almost same of 60 kA. In the SR method, the averaged toroidal magnetic field is self-generated from approximately 50 G to 800 kG. It is confirmed that the reversal of toroidal magnetic field of the SR method is weak as compared to that of the AR method. As a result, the duration time of the RFP discharge becomes short. It is necessary to examine what kind of instabilities with dynamo activities occurred in the SR method.