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RELAXにおける球状RFPプラズマ研究の現状と今後の展開
Recent Status and Future Plans in Spherical RFP Plasma Research in RELAX

三瓶明希夫, 政宗貞男, 田中裕之, 西村香苗, 石井豪, 上羽涼太, 小寺良典, 比村治彦, 秋山毅志[1], 大舘暁[1], 水口直紀[1], 川端一男[1], 江尻晶[2], 小口治久[3], D.J. Den Hartog[4], K.J. McCollam[4], R. Paccagnella[5]
Akio SANPEI, Sadao MASAMUNE, Hiroyuki TANAKA, Kanae NISHIMURA, et al.

京都工繊大, 核融合研[1], 東大[2], 産総研[3], Univ. Wisconsin[4], Consorzio RFX[5]
Kyoto Inst. Tech., NIFS[1], Univ. Tokyo[2], AIST[3], Univ. Wisconsin[4], Consorzio RFX[5]

The reversed field pinch (RFP) is a compact, high-beta magnetic confinement concept, characterized by self-organization of the magnetic configuration and dominated by magnetic fluctuations excited by resistive magnetohydrodynamics (MHD) instabilities. An equilibrium analyses have shown that mode rational surfaces are less densely spaced by lowering the aspect ratio ($A = R/a$) of the RFP configuration, where R (a) is the major (minor) radius of the plasma column, therefore simpler MHD mode dynamics is expected in low-A RFP. It is also expected that trapped particle fraction also increases in low-A. Moreover, in low-A equilibrium, self-induced bootstrap current tends to increase [1], which may reduce the electric current needed from an external source. In order to study these attractive characteristics of low-A RFP configuration, experimental study has been carried out in REversed field pinch of Low Aspect eXperiment (RELAX) [2] device with R=0.51 m/a=0.25 m, $A = 2$. The device is operated with a 4 mm SS vacuum vessel (field penetration time $\tau_w < 3$ ms). Recent experimental results have shown that low-A RFP plasmas have been obtained with plasma current I_p of up to 125 kA and loop voltage V_l of down to ∼30 V, discharge duration of up to 3.5 ms, electron density in the range from 0.2 to 2.0 $\times$ 10^{19} m^{-3}.

Recent progress in RELAX includes feedback control of field errors and stabilization of a resistive wall mode. The feedback experiments have been conducted to stabilize a specific mode (m=1/n=2) by using limited number of the power supplies, resulting in increased plasma current with longer discharge duration up to ∼3.5 ms [3]. The visible light and the soft X-ray (SXR) diagnostic with high-speed camera have revealed simple helix structure in shallow reversal discharge [4]. Existence of a large magnetic island has been suggested from the SXR images with a computed tomography technique and a field line tracing technique. Thomson scattering measurement has shown that the central electron temperature is around 100 eV at plasma current of 50-80 kA, increasing with I_p [5]. A super-sonic gas puffing system to control the plasma pressure profile has been constructed and initial experiments have been started [6]. Details of the above-mentioned characteristic behaviors of low-A RFP plasmas will be discussed.

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[1] S. Shiina et al., Phys. Plasmas. **12**, 080702 (2005).
[2] S. Masamune et al., J. Phys. Soc. Jpn. **76**, 123501 (2007).
[3] R. Kodera et al., *poster 05pE59P in this conference.*
[4] A. Sanpei et al., IEEE Transaction Plasma Science **39**, 2410 (2011).
[5] R. Ueba et al., *poster 05pE58P in this conference.*
[6] G. Ishii et al., *poster 05pE57P in this conference.*