Contribution ID: **1254** Type: **Regular Poster**

Experimental Results on Current Drive by Lower Hybrid Fast Wave in VEST

Friday 14 May 2021 12:10 (20 minutes)

A series of preparations and experiments has been carried out to study the feasibility of current drive by Lower Hybrid Fast Wave in VEST since 2014[1~7]. The RF system had been prepared and installed until 2017. The power coupling study was conducted at about 3 kW in 2018 as shown in Figure 1(a). It was confirmed that LHFW could be launched by the magnetic probe wave measurement as shown in Figure 1(c). However, the chagne of plasma parameters and driven current was very low due to narrow coupling window from low toroidal field of 0.1 T. It was obscure to confirm the increase of plasma current as shown in Figure 1(b). In addition, higher power injection was impossible by the multipactoring damage of RF window as shown in Figure 1(d).

Figure 1: Fig. 1. Forward/Reflect/Transmitted/Coupled Power of #20845 (a), Edge plasma density, temperature and plasma current (b), Perpendicular wave number measured (c), RF window damaged by multipactoring (d).

In 2019 the toroidal magnetic field was increased to 0.2 T where coupling window expansion and coupling improvement into the core plasmas are expected. The RF window was upgraded to avoid the multipactoring discharge as well. In spite of the RF window change, the multipactoring took place still, but, fortunately, pulse power operation was possible in less than 2 msec length. As shown in Figure 2.(a), RF power upto about 6 kW was coupled to VEST 25 kA plasma with about 20 msec length. Electron temperature increased in phase of the RF power injection except about 508~512 msec where the density window for core plasma is thought to be closed. The max driven current was about 1 kA near 507 msec which corresponds to the figure of merit of about 5 when it is normalized with density of 10^{16} m^{-3}. It should be considered that the plasma is sustained by Ohmic power and the temperature is as low as 50 eV even in core plasma.

Figure 2: Fig. 2. RF powers(top) and plasma current difference between shots with RF and without RF injection(bottom) (a), Edge plasma density(top) and temperature(bottom) (b).

The feasibility of current drive by LHFW was confirmed in the experiment of VEST. More precise and higher power experiment will be conducted in the future. The measurement of hard X-ray by high energy electron tail is in the preparation and enhanced antenna conditioning for higher power injection is planned. The detailed experimental results will be presented in the conference.

References:
1. S.H.Kim et al., Fusion Engineering and Design, 109-111, 707-711 (2016).
2. S.H.Kim et al., EPJ Web of Conferences, 157, 03023 (2017).
3. K.J.Chung et al., Plasma Science and Technology, 15, 244 (2013).
4. S.H.Kim et al., 2017 International Spherical Tokamak Workshop (2017).
5. H.W.Lee et al., Fusion Engineering and Design, 136, 1505-1509 (2018).
6. J.G.Jo et al., Physics of Plasmas, 25, 082511 (2018).
7. S.H.Kim et al., 27th Fusion Energy Conference (2018).

Affiliation

Korea Atomic Energy Research Institute

Country or International Organization

Korea, Republic of

Author: Dr KIM, Sun-Ho (Korea Atomic Energy Research Institute)

Co-authors: Dr JO, Jong-Gab (Korea Atomic Energy Research Institute); Mr WANG, Jong-In (Seoul National University); Prof. HWANG, Yong-Seok (Seoul National University)

Presenter: Dr KIM, Sun-Ho (Korea Atomic Energy Research Institute)

Session Classification: P7 Posters 7

Track Classification: Magnetic Fusion Experiments