

Development of EC system components for steady state plasma operation

Yasuhisa ODA¹⁾, Ryosuke IKEDA¹⁾, Koji TAKAHASHI¹⁾,
Ken KAJIWARA¹⁾, Keishi SAKAMOTO¹⁾, Franco GANDINI²⁾,
Caroline DARBOS²⁾, Dharmesh PUROHIT²⁾, Mark HENDERSON²⁾

1) Japan Atomic Energy Agency

2) ITER Organization

oda.yasuhisa@jaea.go.jp

For steady state plasma operation, EC H&CD system components, such as transmission line (TL), are required to be compliant with high power CW operation. One of issues of EC H&CD TL for steady state operation is the deformation of TL system due to thermal load by high power operation. The controllability of TL components during RF operation is another issue for steady state operation. In JAEA, ITER relevant TL was examined for long pulse operation up to 1,000 sec using a 170 GHz high power gyrotron.

The TL test stand in JAEA is composed of 63.5 mm diameter corrugated waveguide(WG) system. The TL test stand delivers 170 GHz high power RF from the gyrotron to dummy loads or the ITER equatorial port launcher (EL) mockup. The mode purity of RF power in WG is important for steady state operation since unwanted modes increases RF power loss in TL and launchers. While high power RF operation of TL, TL components are heated by RF loss in components and the thermal expansion of the long section deforms neighboring sections. The deformation of WG system increases the mode conversion in TL. In JAEA TL test stand, the mode conversion caused in during the 1000 sec operation was measured and the effect of long pulse operation on mode purity will be discussed.

For steady state plasma operation, EC power is required to switch its injecting launcher even during RF power injection. Indeed for the operation of mechanical switch during gyrotron pulse, RF power pause control is mandatory synchronizing motion of switch device. The WG switch operation was demonstrated in JAEA test stand during the 150 sec operation of high power gyrotron at 400 kW level. The synchronizing of RF power suspend and resume with switch motion was succeeded with ITER relevant control system and RF power direction control during the gyrotron operation was succeeded.