8th Asia-Pacific Conference on Plasma Physics, 3-8 Nov, 2024 at Malacca

Fabrication and characteristics of 5 kW high-density helicon plasma linear device

M. Nisoa[1,2], S. Kaewpawong[2], W. Kongsawat[2], R. Taleh [2], D. Srinoum[2], A. Tamman[3], S. Dangtip[3] and B. Chatthong[3]

[1] Division of Physics, Walailak University, [2] PEwave, Walailak University, [3] Thailand Institute of Nuclear Technology, [4] Department Physics, Prince of Songkla University

e-mail (speaker): nmudtorl@wu.ac.th

High-density linear plasma devices can produce plasmas similar to those of Tokamaks, but they are simpler, more compact, and more cost-effective for plasma-material interaction (PMI) research. In this study, we fabricated a linear helicon plasma device using permanent magnets. The device employs a half-turn helical antenna and 13.56 MHz RF to excite helicon waves in the m = +1 mode[1-4]. The magnetic field, uniform at 800 G near the antenna, along with Ar gas, was used for plasma discharges. Electron temperatures and plasma densities were measured using optical emission spectroscopy (OES) and a Langmuir probe. With RF power up to 5 kW, high-density plasmas exceeding 10^{13} cm^{-3} were achieved, and electron temperatures ranged from 1 to 5 eV. This newly developed linear helicon plasma device is excellent for PMI studies and crucial for developing fusion-related materials. The ion fluence, similar to that of the plasma-facing wall in Tokamaks, can also be investigated.

References

[1] M Nisoa, Y Sakawa, T Shoji, Compact high-density plasma source produced by using standing helicon waves, Jpn. J. Appl. Phys. 38 L777, 1999

[2] M Nisoa, Y Sakawa and T Shoji, Plasma Production by m=0 Standing Helicon Waves, Jpn. J. Appl. Phys. 39 L429, 2000

[3] M Nisoa, Y Sakawa, T Shoji, Characterization of Plasma Production by m=0 Standing Helicon Waves, Jpn. J. Appl. Phys. 40 3396, 2001

[4] R. H Goulding et al., Progress in the Development of a High Power Helicon Plasma Source for the Materials Plasma Exposure Experiment, Fusion Science and Technology, (2017)