Electron Bernstein wave diagnostic development on the TST-2 spherical tokamak

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The electron Bernstein wave (EBW) emission diagnostic has been considered as an alternative to the standard ECE electron temperature diagnostic for overdense plasmas like ST. In order to estimate the electron temperature from EBE emission intensity, the mode-conversion efficiency from EBW to electromagnetic modes must be diagnosed simultaneously. To address this issue, we have developed a radio-reflectometer that measures EBW emission in the frequency range of 5 - 12GHz and the density profile of the upper-hybrid resonance layer. Both instruments share the same local oscillator and receiving antenna. The radiometer is absolutely calibrated using liquid nitrogen and measures the second and third harmonic emissions from TST-2 plasmas. The reflectometer employs the amplitude modulation technique to prevent the reflected microwave from disturbing the radiometer.

For typical TST-2 plasmas with plasma current of 100 kA, emission levels corresponding to the 100-150eV are measured from plasma core region. The mode-conversion efficiency calculated by a 1-D fullwave code using the measured edge density profile is 0.5-0.8 leading to the electron temperature of approximately 200 - 300 eV. The results from recent experiments with expanded frequency coverage of 5 to 16GHz will be also presented.

Subject area: Plasma diagnostics of special interest