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Measurements of electron Bernstein wave emission on SUNIST spherical tokamak

The electron Bernstein wave (EBW) is a promising method for heating and current drive in overdense plasmas. To evaluate spontaneous conditions for EBW heating on SUNIST spherical tokamak, EBW emissions in the frequency of 3 to 6 GHz, corresponding to the fundamental and second harmonic in low toroidal field (0.1 T) discharge, were measured and analyzed. Emissions were collected by an in-vacuum quad-ridged horn antenna after mode conversion processes (B-X-O & B-X) and multi-reflections in the transmission tube, and then measured by two radiometers outside the vacuum. The edge electron density profile was measured by a Langmuir probe array and mode conversion efficiencies (TBXO & CBX) were thus calculated. The depolarization effect due to multi-reflections were evaluated through a HFSS simulation. X/O ratios measured by two radiometers were consistent with prediction values from the calculation and simulation. Emission intensities of different frequencies were calculated and then compared, and an electron temperature profile was obtained. Without absolute calibration for the antenna and radiometers, the temperature profile is relative. Results also indicated that the spontaneous edge density profile in SUNIST is suitable for O-X-B heating scheme, and needs to be steeper for the X-B heating scheme.

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