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Parametric analysis of spectral intensity of electron cyclotron radiation coming out of plasma in ITER

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Electron cyclotron (EC) radiation in ITER due to high electron temperature and high magnetic field besides its important role in power loss balance [1, 2], will be a source of additional thermal and electromagnetic loads for microwave and optical diagnostics [3]. EC radiation from the plasma dominates over the nominal stray radiation from electron cyclotron resonance heating (ECRH) and current drive (ECCD) microwave power sources in high performance discharges of ITER operation and therefore its implication for diagnostics must be investigated [3]. This is especially important for mm-wave diagnostics in ITER such as microwave reflectometers, and Collective Thomson scattering system, whose transmission lines allow, in principle, additional measurements of EC radiation spectra [4]. Although the working frequency range for these diagnostics is significantly lower than the operational frequency for ITER ECRH system (˜ 170 GHz), their antennas and waveguide can receive the entire emission spectrum at frequencies above 12 GHz. Electromagnetic loads strongly depend on the spectral distribution of the EC radiation emerging from the plasma to the first wall and areas behind blankets and in port plugs, where there is usually less heat sink presented.
Here we report on calculations with the CYNEQ code [5, 6] of the spectral intensity of EC radiation coming out of plasma for typical scenarios of ITER operation and various values of surface-averaged reflectivity of the first wall. It is shown that for high values of surface-averaged reflectivity of the first wall (Rw = 0.9), the energy flux density may attain the values of ˜ 100 kW/mˆ2, and its spectral distribution is located mainly in the range 500-1500 GHz.

References

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