Electron Cyclotron Current Drive at High Electron Temperature*

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Most experimental tests of electron cyclotron current drive (ECCD) have been at electron temperatures an order of magnitude lower than expected on ITER; thus, there remains a need to validate ECCD theory in the ITER temperature regime. Experiments on DIII-D have measured the ECCD efficiency for co- and counter-injection in low-density plasmas with radiation temperatures from electron cyclotron emission above 20 keV. The radiation temperature is generally higher than the Thomson scattering temperature, indicating that there is a significant population of non-thermal electrons that is largest for counter-injection, less for co-injection, and smallest for radial injection. The experimental ECCD profile measured with motional Stark effect polarimetry is found to agree with the quasi-linear CQL3D Fokker-Planck code except for the highest power density cases ($Q_{EC}/n_e^2 \gg 1$). Radial transport of the current carrying electrons, which can be modeled in an *ad hoc* manner in CQL3D, may explain the lower ECCD since the measured current drive profile is substantially broadened for the high power density cases.

*Work supported by USDOE under DE-FC02-04ER54698, DE-FG03-97ER54415, DE-FG02-99ER54541, and W-7405-ENG-48.