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ICC/P5-01: Results from LTX with Lithium-Coated Walls

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The Lithium Tokamak eXperiment (LTX) is a low aspect ratio tokamak with R=0.4 m, a=0.26 m, and kappa=1.5. Typical discharge parameters are now: Toroidal field of 2.1 kG, plasma current less than 100 kA, and discharge duration less than 25 msec. LTX is fitted with a conformal 1 cm thick heated copper liner or shell. The plasma-facing surface of the shell is clad with stainless steel, and is conformal to the last closed flux surface (a close-fitting wall). The shell can be heated to 300 - 400 C, and coated with lithium. LTX was designed to investigate the modifications to tokamak equilibrium with low recycling walls of liquid or solid lithium. With a close-fitting high-Z wall, discharges are strongly affected by wall conditioning. In LTX, the only wall conditioning technique used is lithium coating. Discharges without lithium wall coatings are limited to plasma currents of 15 kA, and discharge durations of order 5 msec. With lithium coatings discharge currents exceed 70 kA, and discharge durations exceed 20 msec, a factor of 4-5 increase in both peak current and duration. Peak electron temperatures, from preliminary Thomson scattering measurements, range from 100 –200 eV. Electron temperature profiles for lithium-wall discharges will be presented. Preliminary estimates of local recycling using an extensive set of Lyman-alpha detectors will be discussed. Other spectroscopic diagnostics include edge measurements of impurity lines, and a scanning VUV spectrometer. Discharge fueling employs gas injection. We have studied the fueling efficiency of a number of different gas injection techniques, including supersonic gas injection, and molecular cluster injection. The use of highly directed gas jets results in the highest fueling efficiencies, up to 0.35. A system to fill each of the two the lower shell segments with up to 50 g of liquid lithium has been constructed and is now undergoing testing. Experiments will begin in early spring 2012, and results will be presented. Spectroscopic measurements of the Doppler shifted emission of Li ions have been made to estimate the ion temperature and rotation profiles of LTX discharges. Detailed analysis is in progress and preliminary results will be reported. This was work supported by USDoE contracts DE-AC02-09CH11466 and DE-AC05-00OR22725.

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