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Impurity Ion Temperature and Flow Dynamics During Local Helicity Injection on the Pegasus Toroidal Experiment[1] M.G. BURKE, R.J. FONCK, University of Wisconsin-Madison — Anomalous energetic thermal and non-thermal minority ion distributions are observed during local helicity injection current startup. Energetic ions in significant numbers can transfer a large amount of power to plasma electrons during helicity injection, which can alter the helicity balance and consequent plasma startup via reduced resistive dissipation. Multi-spatial point spectra from a 1 m F/8.6 Czerny-Turner polychromator are recorded by an intensified high-speed camera with a time resolution of 500 μs. T_e remains low during helicity injection, wherein the plasma experiences large magnetic fluctuations and strong reconnection activity near the injection region. Partially ionized low-Z impurities (CIII, NIII, and OIII) exist in the core plasma region, which allows core T_i measurements. Strong impurity ion heating ($T_i \approx 1.2$ keV, $T_e \approx 0.1$ keV) correlates with $n = 1$ MHD activity. High frequency magnetic fluctuations are indicated at frequencies close to the impurity ion cyclotron frequencies and may act as the source of energy for the ions. These observations motivate the deployment of a neutral particle analyzer to measure the working gas ion distributions in these plasmas. In addition, a high-throughput polychromator with 2 μs resolution is being installed to more directly correlate the observed impurity ion heating and flows with MHD and reconnection activity.

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