Extreme degree of ionization in micro-capillary plasma columns heated by ultrafast current pulses\(^1\) JORGE ROCCA, JING LI, GONZALO AVARIA, MICHAEL GRISHAM, FERNANDO TOMASEL, VYACHESLAV SHLYAPTSEV, Colorado State University — The efficient generation of dense large-scale plasma columns with very high degree of ionization and high homogeneity can enable fundamental plasma studies and a variety of promising applications. We demonstrate the generation of dense large-aspect-ratio plasmas columns with extremely high degree of ionization in micro-capillary channels heated by ultrafast discharge current pulses. Xenon plasma columns were ionized to the Co-like stage (Xe XXVIII) injecting 37 kA current pulses with 4 ns risetime into of 500 micrometer diameter, with lines from the Fe-like ion (Xe XXIX) also visible in the spectra. Sequences of time-resolved filtered pinhole images of the plasma column show a symmetric compression leading to 300:1 aspect-ratio plasma channels. The experimental results, that include ionization of Al impurities up to the H-like stage, support model simulations in showing that rapid ohmic heating of micro-capillary channels with relatively modest currents can generate very hot dense plasma columns which electron temperature could approach 1 KeV.

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