Spectroscopy and implosion dynamics of combined W and Al X-pinches and their comparison with W wire arrays produced on the UNR 1 MA z-pinch generator


— Experiments on the 1 MA Zebra generator at UNR with combined planar-loop X-pinches composed from high-Z (W) and low-Z (Al) materials provide a unique opportunity to study M-shell radiation of W. In particular, X-pinches with a 35 $\mu$m W wire in the top loop and a 99 $\mu$m Al wire in the bottom loop as well as reversed, Al at the top and W at the bottom, of the same diameter, were analyzed and compared. In addition, wire arrays with 5 $\mu$m W wires coated with 5% NaF were investigated and compared with X-pinches. Spatially-resolved and integrated x-ray spectral data and time-resolved and integrated pinhole x-ray images accumulated in these experiments were analyzed. Modeling of K-shell radiation from Al, Mg, and Na ions provides K-shell plasma parameters. Modeling of M-shell radiation from W provides parameters for M-shell plasmas. Based on this modeling, Al and W radiation is analyzed and compared for different wire loads. The importance of using different materials, dopants, and load configurations for understanding the radiative properties of W is illustrated. Work supported by the DOE/ NNSA under UNR grant DE-FC52-01NV14050 and by Sandia National Laboratories under DOE contract DE-AC04-94AL85000.

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