MULTIDIMENSIONAL DYNAMICS AND STRUCTURES EFFECTS ON THE RADIATION AND IMPLOSION PHYSICS OF ALUMINUM/MAGNESIUM NESTED WIRE ARRAYS ON THE REFURBISHED Z SIMULATOR*

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A series of Al/Mg nested wire array Z-pinch load experiments has been recently performed on the refurbished Z accelerator. The earlier comparison study of the results from 1D and 2D radiation MHD simulations of the Sandia Z1907/1908 experiments [Y. K. Chong, et. al, APS09] has shown that, in addition to the substantial difference in the prediction capability of the 1D and 2D models, the radiation physics and implosion dynamics of the plasmas are significantly affected by the nonuniform structures and inhomogenities. In this study, we extend the mass scaling analysis of the radiation for 50mm diameter arrays through a detailed investigation of the complex nonlinear interaction dynamics between the multidimensional structures and the ambient radiation, and the resulting effects on the radiation plasma ensemble. In particular, we focus on the temporal and spatial evolution of the mass, momentum and energy flow distribution under the driving force field, and of the radiation emission and nonlocal transport processes. The study will employ the mach MHD codes with an improved dynamical domain TCRE (DDTCRE) transport [Y. K. Chong, et. al, ICOPS 2005] which affords a much greater flexibility and capacity in the grid resolution and the physics detail. The investigation is further aided through the detailed postprocess analysis of the K- and L-shell radiation yield and power signatures, as well as the spectral and spatial characteristics of the radiation during the various stages of the Z-pinch implosion process using the AXSTRAN, a 2D self-consistent non-LTE radiation ionization dynamics code with multifrequency integral transport and detailed configuration atomic model, in conjunction with the SPECAM 3D non-LTE spectra and image synthesizer code.

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