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EFFECT OF THE PREPULSE CURRENT ON THE PRECONDITIONED ALUMINUM WIRE ARRAY Z-PINCH

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Preconditioned wire array Z-pinch experiments are carried out based on a double-pulse current generator "Qin-1"facility. The facility can generate a ˜300 kA/300 ns current pulse with a charging voltage of ±35 kV, when driving the preheated aluminum wire array (8 wires, diameter of 1 cm, length of 1 cm). The feature of this facility is that an adjustable prepulse current (˜15 kA/45 ns) can be preset to preheat the wire array. The implosion dynamics of the wire array are highly related to the initial mass distribution of the wires, which can be regulated by the prepulse parameter.

The initial mass distribution and spatial size of the load can be regulated by changing the time interval (Tdelay) between the prepulse and the main pulse. Experimental images show that the ablation behavior changes dramatically when Tdelay varies from 400 ns to 1 us. It is noteworthy that a thin shell implosion is obtained in the case of Tdelay=1 μs. The characteristic parameters of instability are also different in the cases with changing Tdelay. The radiation power of X-ray is recorded with filtered PIN detectors, and the results shows that an optimized Tdelay can exist to obtain a higher X-ray power.

An optimization of the prepulse current can be achieved using a vacuum gap switch in the connection area of the electrodes of the main pulse and prepulse generators. In the case with the gap switch, it is observed that the gasification degree of the load is greatly improved compared to the condition without the switch. The X-ray radiation power of preconditioned wire array Z-pinch in this case is close to the normal electrode condition. However, the X-ray power of Z-pinch driven by a single pulse current is greatly improved compared to the case without the gap switch.

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