

**HY-Tech Research Corporation, “Fabrication of Wire Loads for Soft X-ray Sources”, R.C. Hazelton, C.C. Klepper, J.J. Moschella, E.J. Yadlowsky, F. Barakat, J. Niemel, HTML No. 98-077**

HY-Tech Research Corporation has a program in the area of plasma radiation sources (PRS). The most common PRS is the z-pinch. On today’s pulsed power accelerators, multi-mega-amperes flow through a z-pinch load, typically wire arrays, which implode producing high density ( $>10^{19} \text{ cm}^{-3}$ ), hot plasmas. These become intense x-ray sources for high energy density physics experiments.<sup>1</sup> The purpose of this work was to produce z-pinch loads with thin (5-25 $\mu$ ) aluminum wires and to uniformly coat them with a thin layer of an element such as Si, which can be used as a seed for diagnostic purposes. The coating is carried out at HY-Tech using an electron beam evaporator and a specially designed rotisserie to expose all sides of the wires. Because of their fragile nature, special handling of the wires is an important part of the process. The goal of the analysis at HTML was to determine the quality and uniformity of the coating. An SEM was used for this work. Figure 1 shows a few SEM images of a cross-section of a 25  $\mu$  Al wire, coated with  $\sim 1\mu$  Si. The non-uniformity of the coating is mostly due to the roughness of the commercially obtained wire. Based on the analysis, the process will be modified and new sample will be analyzed. One scheme will be to coat the wires with a layer of Al before depositing the Si. Adding a protective layer of Al on top of the Si will also be tried. After this series, 15 and 10  $\mu$  wires will be produced and analyzed.

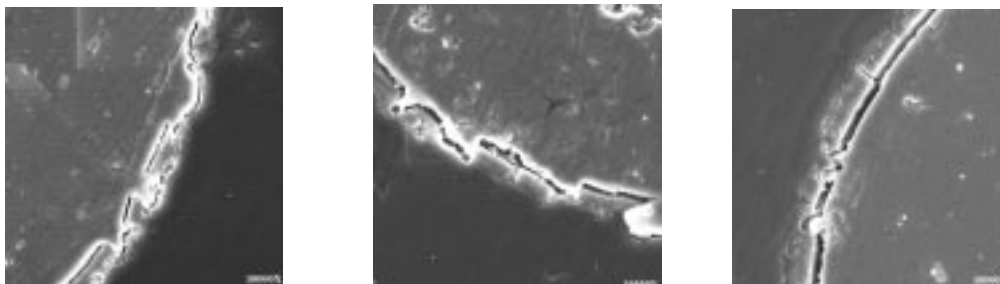


Figure 1. SEM images of a cross-section of a 25  $\mu$  wire, coated with  $\sim 1 \mu$  of Si. The voids are due to the Si layer attaching to the epoxy (used in the sample preparation) and separating from the Al wire substrate.

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<sup>1</sup>M.Keith Matzen, Phys. Plasmas 4 (5), May 1997

These wire loads were made, in part, for use in a newly commissioned z-pinch facility here at HY-Tech Research. They were in fact used in some of the first shots of this low current (0.6MA, 300kA) device. Figure 2 shows a photograph of the imploding wires. This time-lapse photography was done on film. It is possible to see the individual wires from the early part and the collapsing pinch from the later part of the 150ns pulse.

OPEN SHUTTER EXPOSURE OF WIRE LOAD HIGH DENSITY  
Z-PINCH (HDZP1) 300kA, 150nsec rise. SHOT 172.  
MARCH 26, 1999 HY-TECH RESEARCH CORPORATION

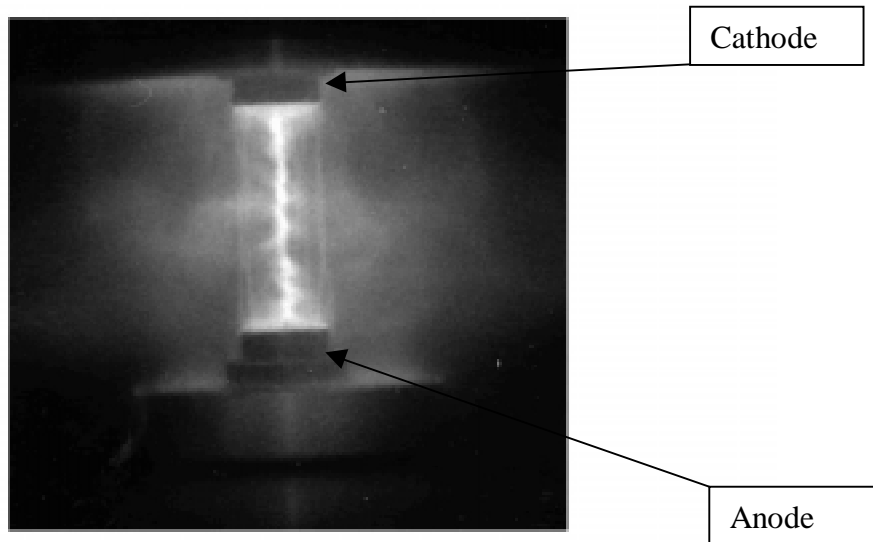


Figure 2. Time-lapsed image of z-pinch implosion, as titled. (The original wires are visible. Plasma instability related structures are seen in the imploded plasma).