



# AEC-NASA TECH BRIEF



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## Fabrication Techniques Developed for Small-Diameter, Thin-Wall Tungsten and Tungsten Alloy Tubing

The fabrication of tungsten and tungsten alloys into small-diameter, thin-wall tubing of nuclear quality is difficult because of the high strength and high-ductile brittle transition temperature (DBTT) of these materials. The high DBTT (from 200° to 400°C) necessitates warm-working in a temperature range of limited familiarity. Tubing is required with diameters of 0.32 cm od or less, and with wall thicknesses of approximately 10% of the outer diameter.

The report describes methods for producing tungsten or tungsten-25 w/o rhenium (W25-Re) tube-blanks by double extrusion. The starting material, generally a pressed and sintered product, is in the form of a sleeve 3.17-cm od by 2.54 cm id and  $\approx$ 10.2 cm long. Both initial and reextrusion processes use a filled-billet technique. The resultant tube blanks,  $\approx$ 0.64-cm od by 0.51-cm id and 75 cm long, are structurally sound and suitable for secondary fabrication operations.

Secondary fabrication until recently has received little attention. Investigations have been carried out on swaging, ductile-core, mandrel, and plug-drawing techniques, but little tubing has been produced.

Work has been done on secondary fabrication operations, concentrating on the W-25 Re alloy. Plug-drawing has emerged as an excellent technique, both for the reduction of the overall tube dimensions and for the removal of the longitudinal surface striations resulting from the filled-billet extrusion sequence. Plug-drawing also obviates the need for core removal

at the finished-tube size ( $<0.125$ -in. od). Even at larger tube sizes, core removal remains a problem.

### Notes:

1. Further details are contained in "The Development of Techniques for Fabrication of Small-Diameter, Thin-Wall Tungsten and Tungsten-Alloy Tubing," by W. R. Burt, D. C. Brillhart, and R. M. Mayfield of Argonne National Laboratory in ANL-7151, July 1966. The report is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151; price \$3.00 (microfiche \$0.65). The report covers extrusion development and stresses secondary fabrication of extruded tubing, concentrating on the W-25 Re alloy.
2. The report offers plans and recommendations for further research in the area of secondary fabrication. Early results of industrial participation are presented.
3. Inquiries concerning this innovation may be directed to:

Office of Industrial Cooperation  
Argonne National Laboratory  
9700 South Cass Avenue  
Argonne, Illinois 60439  
Reference: B68-10284

Source: W. R. Burt, D. C. Brillhart,  
R. M. Mayfield, and F. J. Karasek,  
Metallurgy Division  
(ARG-10100)

(continued overleaf)

**Patent status:**

Inquiries about obtaining rights for commercial use of this innovation may be made to:

Mr. George H. Lee, Chief  
Chicago Patent Group  
U.S. Atomic Energy Commission  
Chicago Operations Office  
9800 South Cass Avenue  
Argonne, Illinois 60439