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NASA TECH BRIEF

Lewis Research Center

Tungsten-Reinforced Tantalum

The problem:

To produce a material with high temperature, above 1366K (2000°F), creep strength approaching that of tungsten but easily fabricated into complex shapes.

The solution:

Tungsten-reinforced tantalum, a structural material possessing the high temperature strength of tungsten and the room temperature ductility and weldability of tantalum. This material is produced by bonding together and overlaying a structure of tungsten wires with chemical vapor deposited tantalum.

How it's done:

The procedure, as used to fabricate 1.9-cm (3/4-inch) outside diameter (O.D.) tungsten reinforced tantalum tubes, is as follows. Tungsten wire is wrapped tightly onto a molybdenum tubular mandrel, alternating circumferential layers and axial layers. The density with which the tungsten wires are packed determines how closely the strength of the resultant tube will approach the strength of tungsten. For example, wire spacing of less than 0.31 mm (0.012 inch) has produced a solid composite containing 36 volume percent tungsten. The wire wrapped mandrel is then coated with tantalum using standard chemical vapor deposition techniques.

The tantalum deposition rate must be decreased with increasing wire packing to allow a void free deposit. The figure shows an axial cross section of a tungsten reinforced tantalum tube.

Temperature cycle tests from room temperature to 1873K (2912°F) have been conducted with no apparent effect on the structural integrity of the composite material.

Notes:

1. Replacing the wire wrap with tungsten screening has also been used successfully.
2. Tungsten reinforced tantalum composite materials can be used in the construction of long life liquid metal transfer systems and high temperature heat pipes.

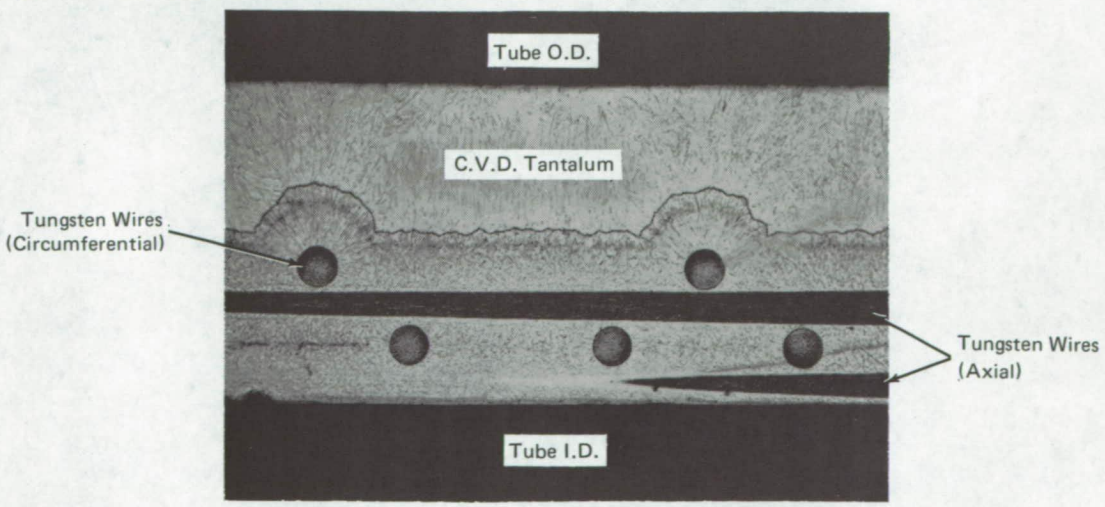

Figure 1. Axial Cross-Section of Tungsten Reinforced Tantalum Tube (F239B)

(continued overleaf)

3. This fabrication technique can be used to construct any wire reinforcing structure that can be made by chemical vapor deposition (CVD) methods. The materials used for the reinforcing and for the CVD bonding agent can be selected on the basis of the resultant properties desired, such as strength at temperature, ductility, weldability, etc.
4. No additional documentation is available. Specific questions, however, may be directed to:

   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B72-10684

Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

Patent Counsel
Mail Stop 500-311
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135

Source: Robert J. Bacigalupi and Roland Breitwieser
Lewis Research Center
(LEW-11750)