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# NASA TECH BRIEF



## Grain Growth Inhibitor for Porous Tungsten Materials

Considerable research has been conducted to develop permeable porous ionizer materials for advanced aerospace applications. Such materials must have specific surface microstructures and open pores quite small in size (1 to 5 microns). Presently, these materials can be produced by powder metallurgy methods utilizing very fine metal powders; however, the materials investigated exhibited poor physical stability at high operating temperatures. Porous tungsten materials operated for prolonged periods above 1100°C experienced dimensional shrinkage and decreased gas flow permeability as the result of grain growth.

Research has shown that boron, either uncombined or combined with nitrogen or carbon added to the tungsten powder prior to processing, effectively inhibits grain growth without appreciably affecting the work function of the porous material. The addition of up to one percent by weight of boron has resulted in porous tungsten materials that are stable at operating temperatures up to 1800°C, for periods up to 6 hours.

**Notes:**

1. Boron powder in elemental form is easily oxidized; boron compounds of nitrogen or carbon are more resistant to oxidation. Boron nitride, for example, reacts with the tungsten during preparatory sintering to form tungsten diboride, while most of the nitrogen escapes as a gas.
2. Documentation is available from:

   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: B68-10527

Questions concerning this innovation may also be directed to:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B68-10527

**Patent status:**

No patent action is contemplated by NASA.

Source: H. H. Todd
of Electro-Optical Systems, Inc.
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