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B72-10199

NASA TECH BRIEF

Ames Research Center

High-Temperature Ceramic-to-Ceramic Seals

The problem:

To produce gas-tight, durable seals between pieces of zirconia ceramics; the seals must withstand temperatures as high as 825°C for years.

The solution:

A noble-metal braze applied to appropriately prepared zirconia parts.

How it's done:

The areas that are not intended to be metallized are masked with stop-off lacquer or tape. Then, the areas to be joined are cleaned in a nonabrasive alkaline cleaning solution.

The unmasked surfaces are sensitized for electroplating by depositing on them a very thin film of platinum or palladium. (Solutions of these metals in contact with the clean zirconia surfaces are reduced by sodium borohydride or hydrazine.)

The sensitized areas are then coated with 0.002 to 0.030 mm of platinum electrodeposited from baths of the composition ordinarily employed for this purpose.

Finally, the metallized surfaces are overlain with preforms of precious metals or their alloys, clamped securely, and the seal is formed by heating in a furnace at the melting point of the alloy.

The metal film plated on the ceramic must have a coefficient of thermal expansion close to that of the ceramic parts to be joined. Thus, gold is to be used on magnesia, platinum on zirconia, and rhodium on alumina. The braze metal should melt at a temperature lower than the metal plated on the ceramic. As a rule, gold or gold alloys can be used as a braze for the ceramics listed above, but since gold braze on gold—magnesia would be difficult to process, a gold—palladium alloy (higher m.p.) should be plated on the magnesia.

Zirconia-to-zirconia seals made as indicated above (platinum with gold braze) have withstood a temperature of 850°C for over 2000 hours without deterioration.

Reference:

Weissbart, J.; Smart, W.; and Wydeven, T.: Oxygen Reclamation from Carbon Dioxide Using a Solid Oxide Electrolyte. Aerospace Medicine, vol. 40, No. 2, p. 136, 1969.

Notes:

1. The following documentation may be obtained from:

   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)
   Reference: NASA CR-73464 (N70-32473), Development of a CO_2-H_2O Solid Electrolyte Electrolysis System.

2. No additional documentation is available. Specific questions, however, may be directed to:

   Technology Utilization Officer
   Ames Research Center
   Moffett Field, California 94035
   Reference: B72-10199

Patent status:

No patent action is contemplated by NASA.

(continued overleaf)

Source: Wilson Smart of
Applied Electrochemistry, Inc.
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