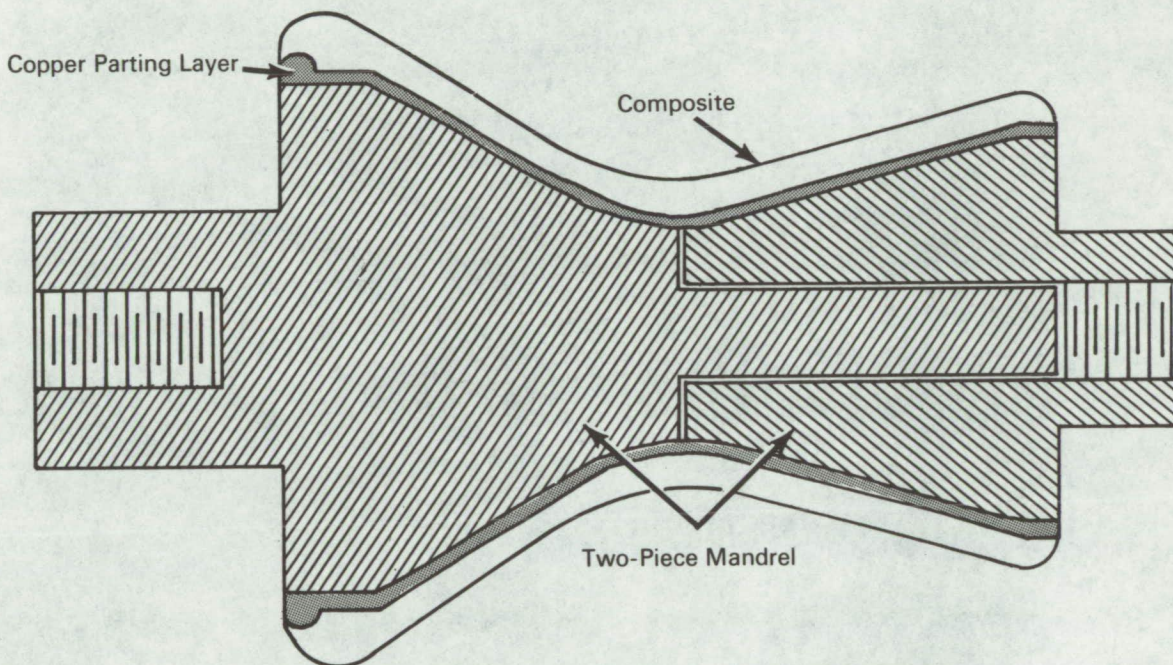


NASA TECH BRIEF



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Multilayer Refractory Nozzles Produced by Plasma-Spray Process



The problem:

To fabricate multilayer rocket nozzles that will have good thermal shock resistance and can be reheated in an oxidizing environment without loss of coating adherence.

The solution:

The nozzles are formed by plasma spraying an interior oxide layer, one or more mixed oxide-tungsten grade layers, and an exterior tungsten layer onto a two piece, separable mandrel.

How it's done:

A two piece mandrel made of type 304 stainless steel is used as a base on which the coatings are

applied by plasma spraying. The two pieces of the mandrel are held together during the spraying process by a thin layer of potassium silicate gel. An unthreaded doweled portion of one half of the mandrel extends through a threaded hole in the other half (on right side of illustration) so that a bolt may be threaded through this hole to force the two halves of the mandrel apart after the spraying process is completed. The threaded hole in the other end of the mandrel is for a shaft used to rotate the mandrel during spraying. A coating of copper, which is applied to the mandrel by flame spraying and then polished, serves as a parting medium.

(continued overleaf)

Commercial spray equipment with a modified feed system to eliminate powder spurting in the gas stream and dropout in the feedlines was used in fabricating four-layer composite nozzles. Spraying of the tungsten was conducted in an inert gas chamber to prevent oxidation of the metal.

Notes:

1. Suggested applications of this process are for the production of refractory components, such as nozzles and containers, which can be formed as surfaces of revolution.

2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Western Support Office
150 Pico Boulevard
Santa Monica, California 90406
Reference: B66-10611

Patent status:

No patent action is contemplated by NASA.

Source: John L. Rausch and J. L. Bliton
of IIT Research Institute,
under contract to
Western Support Office
(WOO-318)