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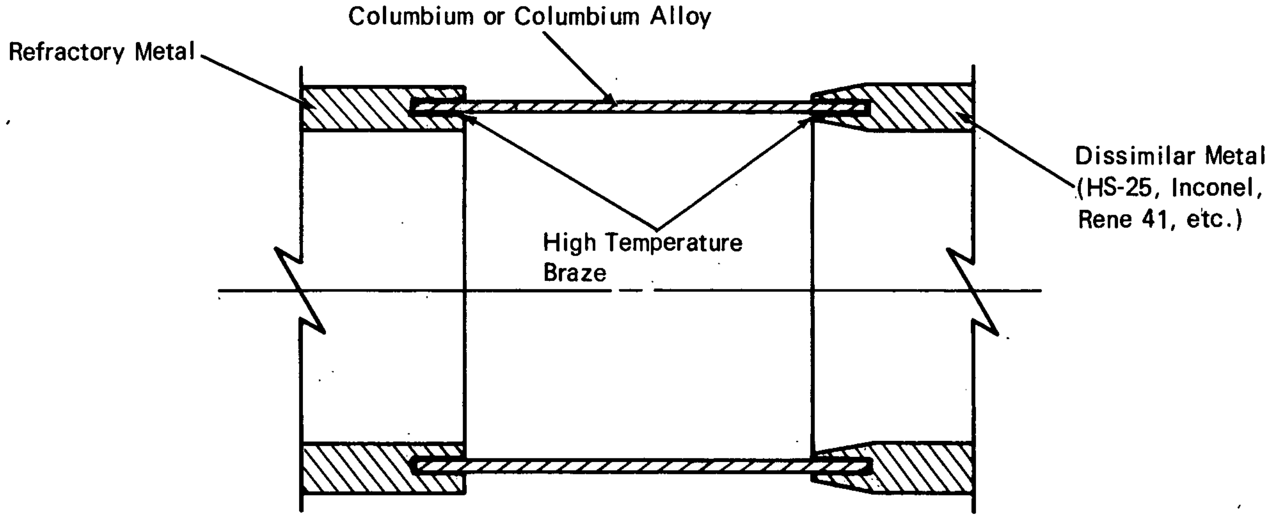
NASA TECH BRIEF

NASA Pasadena Office

Method of Joining Metals of Significantly Different Expansion Rates

The problem:

To join a refractory metal to a dissimilar high-temperature metal of markedly different thermal coefficient of expansion. Direct welding, brazing, and riveting all failed due to cracking, buckling, or joint separation.



The solution:

Braze a section of high elasticity, high ductility metal (such as columbium or columbium alloy) between the materials to be joined, using a fork-type joint to hold the braze and transition member in place during expansion.

How it's done:

The illustration shows a sectional view of a tube of refractory metal (e.g., molybdenum) jointed by a columbium member to a tube of a dissimilar high-temperature metal such as Haynes 25. Axial grooves cut in the ends of the tubes permit joining the columbium member to the tubes using a high-temperature braze material like gold, palladium, or titanium alloy. The end of the Haynes tube is tapered inside and out for a distance greater than the depth of the groove. Thus, the point of highest bending stress in the columbium member is within the brazed joint, preventing failure at the open end of the groove.

As the Haynes tube expands during elevation to the 1311°K (1900°F) braze temperature, the braze gap within the fork joints remains constant and the columbium is subjected to a bending stress. If the columbium member is of sufficient length, the bending stress will be distributed over a gradient from the Haynes tube to the molybdenum tube, resulting in practically no joint stress and a successful transition joint.

(continued overleaf)

The size and shape of the joint is not limited. Joints with an inside diameter of 22.22 cm (8.75 in.) have been successfully made.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP71-10028

Patent status:

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

Patent Counsel
Mail Code 1
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103

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