NASA TECH BRIEF

Lewis Research Center

Braze Alloys for High Temperature Service

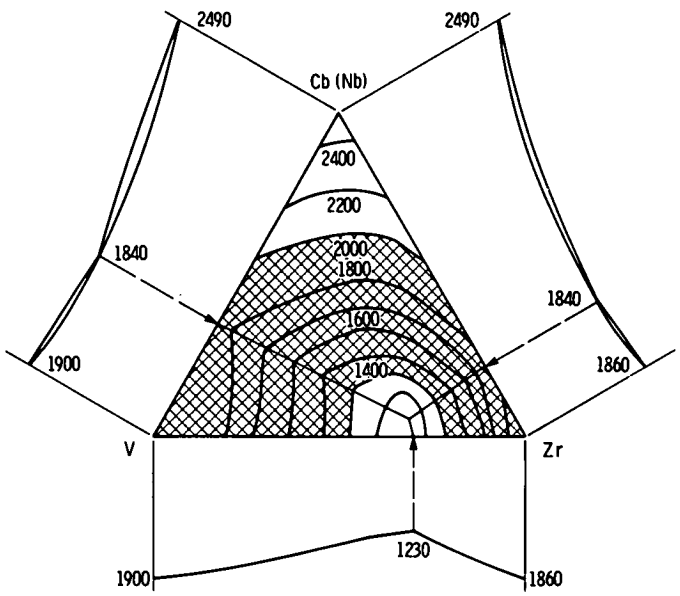

Figure 1. Braze Alloy System for High Temperatures (Values in °C)

Two groups of refractory metal compositions have been developed that are very useful as high temperature brazing alloys for sealing between ceramic and metal parts. Each of the two groups consists of various compositions of three selected refractory metals. Individually, these component refractory metals are not suitable as braze materials; however, combined, they have the required characteristics of good braze alloys.

The first group of braze alloys consists of zirconium, vanadium, and columbium (niobium). The various refractory metal compositions in this group permit brazing in the temperature range of 1400°C to 2000°C. The range of such alloy compositions is depicted by the shaded area of Figure 1.

The second group consists of titanium, vanadium, and columbium. The various refractory metal compositions in this group permit brazing in the temperature range of 1650°C to 2000°C. The shaded area of Figure 2 illustrates the brazing range of such alloy compositions.

Since the temperature-time history of the brazing operation varies depending upon the nature of the specific materials being joined and the rates at which the particular alloy composition react with the surfaces of the parts to be brazed, there is a high degree of flexibility in selecting the braze alloy compositions and in performing the brazing operations. The documentation listed below describes how to select a braze composition and how to use it.

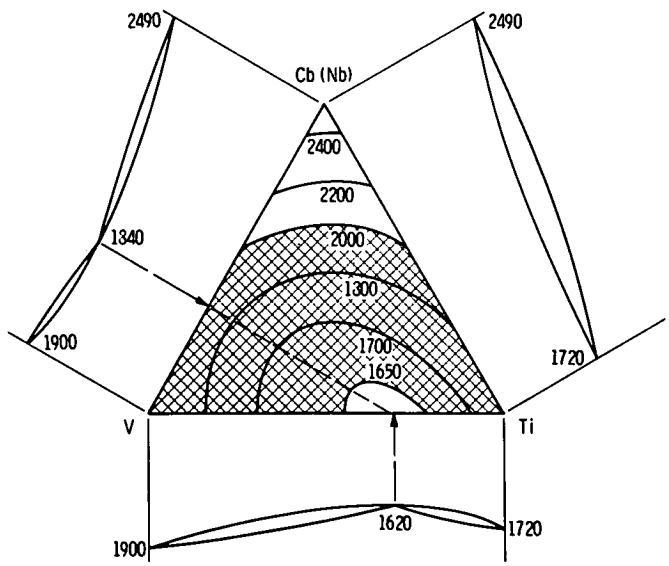

Figure 2. Braze Alloy System for High Temperatures (Values in °C)

Notes:

1. Since refractory metals are subject to oxidation at temperatures above 1000°C, an inert gas environment must be provided for brazing with these refractory metal compositions and for the subsequent use of the brazed joint.

(continued overleaf)

2. Brazes made from these alloy compositions have been tested for use in structures or components at temperatures in the range of 1000°C to 1600°C although satisfactory use at lower temperatures can be expected.
3. 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-72850 (N72-75945), Evaluation of High Temperature Electrical Materials and Components
   Reference: NASA CR-1592 (N70-35822), Thermal-Vacuum Testing of High Temperature Electrical Components
   Reference: NASA CR-1591 (N70-34076), Ceramic-Metal Bore Seal Development

   Single document price $16.75
   (or microfiche $0.95)
   Reference: NASA CR-120831 (N73-14484), High Temperature (1200°C) Ceramic-to-Metal Seal Development

   Single document price $6.00
   (or microfiche $0.95)
   Reference: NASA CR-54093 (N66-35217) Bore Seal Technology – Topical Report

4. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B73-10205

Patent status:

NASA has decided not to apply for a patent.

Source: R. A. Lindberg
Lewis Research Center
and R. L. McKisson and G. Erwin, Jr., of
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