December 1970

Brief 70-10429

NASA TECH BRIEF

High Expansion Coefficient Glasses Can be Sealed to Common Metals

A new series of high expansion coefficient glasses can be sealed by fusion onto the hot surface of metals and alloys. Glass-to-metal seals are used extensively in the electronic and electrical industries. The kinds of metals involved vary from the low expansion coefficient alloys such as kovar (iron-nickel-cobalt), cold rolled steels and nickel, to the high expansion coefficient metals such as copper, stainless steel, and aluminum.

The glasses developed have relatively low working temperatures and good chemical durability, and can be used in electrical insulators and feedthroughs to fluid or vacuum systems. Other applications include oxidation resistant or protective coatings on certain metal alloys for high temperature applications. Some representative samples of these glasses and certain selected properties appear in Table 1.

Sample Glasses, Their Sag Points and Expansion Coefficients

Glass Sample No.	Composition (Wt %) SiO_2	Na_2O	Al_2O_3	K_2O	MgO	CaO	TiO_2	BaO	NaF	Sag Point °C	Expansion Coefficient x 10^6 (inch/inch/°C)
53	39.6	11.6	18.4	---	---	18.4	6.9	---	5.1	593	11.1
54	37.3	11.8	22.4	---	---	14.0	4.7	4.7	5.1	602	9.4
6	64.8	9.6	9.4	13.1	3.1	----	---	---	---	530	13.1

Notes:

1. Sag Point is the temperature at which glass begins to soften or flow.
2. An example of an application for the sample 6 composition is to seal the ends of a conventional electrical heating element where the high-expansion coefficient and good electrical and chemical properties of this glass are a distinct advantage.

Notes:

1. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.60)
   Reference:
   NASA-CR-72520 (N70-14570), Development and Evaluation of Controlled Viscosity Coatings for Superalloys
2. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B70-10429

(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

Source: C. Hirayama, F. E. Camp, and J. W. Chapman of Westinghouse Electric Corp. under contract to Lewis Research Center (LEW-10698)