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NASA TECH BRIEF

Readily Fiberizable Glasses Having a High Modulus of Elasticity

Certain new glass compositions readily yield fibers having a high modulus of elasticity; they comprise silica, alumina, magnesia, and beryllia plus at least one uncommon oxide. In some instances certain other glass-forming ingredients may be included as either partial substitutes for or additions to the basic elements; always, however, the molal ratio of beryllia to the uncommon oxides is between 1:2 and 3:1.

In general the compositions are characterized by (percentages by weight) 20–40 silica, 10–25 alumina, 0–15 magnesia, 3–12 beryllia, 0–12 calcia, 0–20 zirconia, 0–18 zinc, 0–40 yttria, 0–55 lanthana, 0–55 samaria, 0–40 ceria, and 0–55 mixed rare-earth oxides; they must include either at least 20% of one of the last five ingredients or 10% zirconia.

The filaments formed (see Table) have a high modulus-density ratio while retaining substantially all the physical properties desired in glasses of this type. Included in the usual plastic matrices as filaments or yarns, these glasses form composites having higher moduli of elasticity and specific moduli of elasticity than do commercially available glasses. Over a reasonable temperature range the glasses have a viscosity of about 20,000 poises depending on the composition, the optimum viscosity lying between 300 and 1000 poises.

Compositions for specific applications usually depend on not only the required properties of the end product but also the cost of the ingredients—especially in large-volume commercial production. Thus some of the rare-earth oxides such as samaria are barred by their cost from practical utilization; however, their inclusion in a melt by virtue of their presence as impurities in other ingredients has no ill effect on the end product.

Compositions (mol Percentages) and Fiberizabilities of Four Glasses

Ingredient	Glass, No. 344	347	321	318
SiO_2	45	50	40	45
Al_2O_3	15	8.33	15	15
MgO	15	—	30	30
BeO	15	25	—	10
Y_2O_3	10	—	15	—
La_2O_3	—	8.33	—	—
ZnO	—	3.33	—	—
	Molal ratio			
BeO:REO[a]	3:2	3:1	—	—
	Fiberizability			
	Exc.	Exc.	b	c

[a]Rare-earth oxide. [b]Only with difficulty; very poor fiber. [c]Nil.

Note:

The following documentation may be obtained from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

(continued overleaf)

Reference:

NASA-CR-789992 (N66-39687), Investigation of the Kinetics of Crystallization of Molten Binary and Ternary Oxide Systems

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: J. F. Bacon of United Aircraft Corp. under contract to NASA Headquarters (HQN-10593)