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NASA TECH BRIEF

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Readily Fiberizable Glasses Having a High Modulus of Elasticity

Ingredient

SiO₂

Al₂O₃

MaO

BeO

 $Y_{2}O_{3}$

La203

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.

ZnO	— 3	.33 —	
Molal ratio			
BeO:REO ^a	3:2 3	:1 —	
	Fiberizability		
	Exc. E	xcb	
a Bare-earth oxide	bOoly w	ith diffic	or fibor

Compositions (mol Percentages) and Fiberizabilities of

Four Glasses

Glass, No.

347

50

8.33

25

8.33

321

40

15

30

15

318

45

15

30

10

344

45

15

1.5

15

10

^aRare-earth oxide. ^DOnly with difficulty; very poor fiber. ^CNil.

Note:

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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.

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