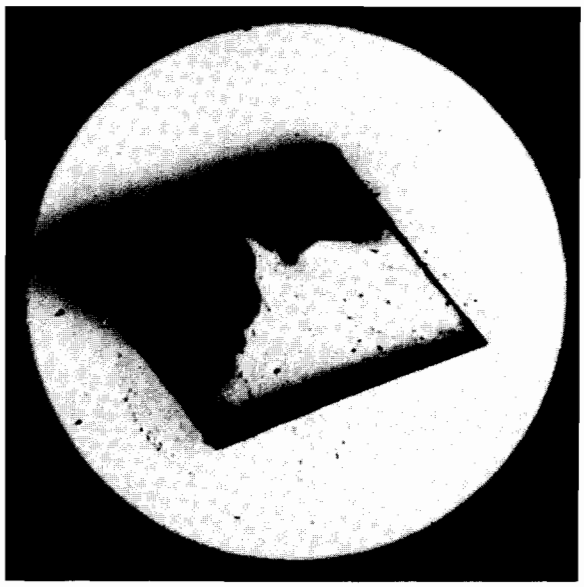
(a)



(b)

Fig. 3. Micrographs (X340) of partially dehydrated crystals of uranyl fumarate dihydrate heated a) at 110 °C for 8 minutes (open pan), b) at 145 °C for 8 minutes (sealed cups).

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Influence of Simulated Waste Oxides on the Durability of a Borosilicate Glass

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Although the numerous papers on the chemical durability of nuclear waste glasses, more work is needed to understand the effects of waste oxides on the glass durability. This is due to the great variety of possible compositions and to the wide leaching conditions [1].

We have prepared the N. 189 glass (England), B, to which we have added 10% and 20% of SrO, Cs_2O, U_3O_8. Furthermore we studied the effects on B of an addition of 4% ZnO [2]. All the glasses were grounded and passed through 40 and 60 mesh sieves to obtain approximately the same surface for the same weight. Powders were leached by water at 70 °C for times varying from 1 day to 24 days and the solutions were analyzed by means of conventional methods.

TABLE I.

	SiO_2	B_2O_3	Li_2O	Na_2O	SrO	Cn_2O	U_3O_4	ZnO	Loss%
B	55.5	29.2	5.0	10.3	–	–	–	–	72.9
SR1	50.4	26.6	4.5	8.4	8.1	–	–	–	83.1
SR2	46.2	24.3	4.2	8.6	16.7	–	–	–	87.7
CS1	50.4	26.5	4.6	9.4	–	9.1	–	–	91.7
CS2	46.2	24.3	4.2	8.6	–	16.7	–	–	97.1
U1	50.4	26.6	4.5	9.4	–	–	9.1	–	73.5
U2	46.2	24.3	4.2	8.6	–	–	16.7	–	75.9
ZN4	53.3	28.0	4.8	9.8	–	–	–	4.0	15.3

In Table I are reported the sample compositions and the percentage of mass leached out after 24 days. In any case the waste ions make poorer the base glass with a maximum for the cesium containing glass. On the contrary the zinc ions, even if in a very low amount, allow very increased resistance to the corrosion [3].

As example in Figs. 1 and 2 are reported the quantitites of SiO_2 and Na species leached out in the course of the experiment.

It must be pointed out that the zinc containing glass continues to dissolve in an appreciable way. This is due to the fact that after 24 days the glass mass is

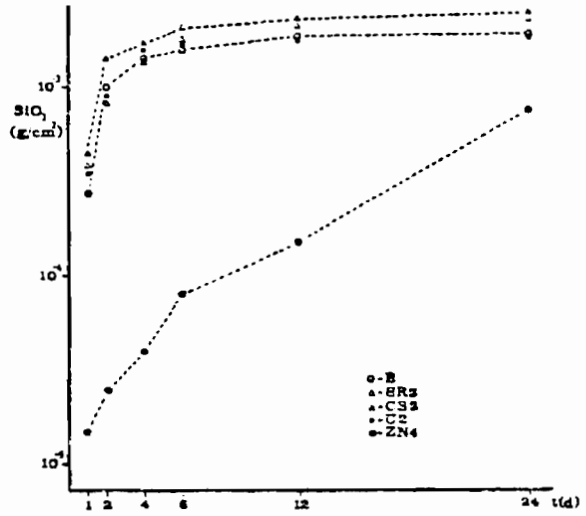

Fig. 1.

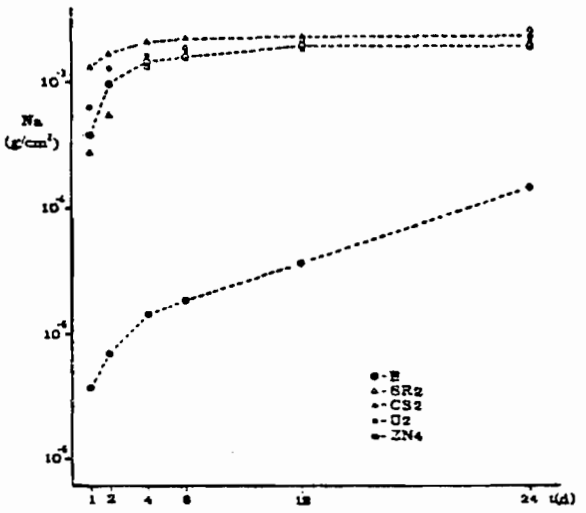

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

not negligible. On the contrary, the other glasses after 24 days are dissolved up to 97%. The different behaviour of the cesium and zinc containing glasses is evidenced also by Figs. 3 and 4, which show the SEM photographs of leached glasses.

IR technique can show the effect of leaching on the glass structure. In Fig. 5 we can see that water transforms the silicate amorphous structure of the glass B in a structure very similar to the vitreous silica [4].

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