Effect of MST on Crystallinity of CST/Sludge Glasses

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EFFECT OF MST ON CRYSTALLINITY OF CST/SLUDGE GLASSES (U)

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Introduction

In support of the Salt Disposition team, the effects of monosodium titanate (MST) on two glass formulations were investigated. These glass formulations combined a blend-type sludge with Crystalline Silicotitanate (CST) and glass formers (or frit). The objective of the testing was to determine if the MST would lead to crystal formation in the glasses.

Experimental Method

Six glasses containing MST, CST, sludge and two different frit compositions (Frit 1 and Frit 2) were vitrified in platinum crucibles at 1150°C. Table 1 lists the concentrations that were used for each frit composition. After melting for four hours, the glasses were heat treated at 1000°C for 24 hours. In addition, baseline glasses without MST were vitrified and heat treated. The samples were then submitted to the Analytical Development Section (ADS) for quantitative analysis by X-Ray Diffraction (XRD).

Table 1 – Frit, Sludge, CST and MST Concentrations Tested

	wt%		
	Column A	Column B	Column C
Frit 1 and 2	68.5	63.5	68
Sludge	26	26	26
CST	5.0	10	5.0
MST	0.5	0.5	1.0

Results

The baseline (without MST) compositions had the same concentrations of sludge and CST. The frit (or glass formers) concentration was increased to compensate for the lack of MST. Columns A and C had identical baseline compositions since each contained the same concentrations of CST and sludge. If the liquidus temperature of the glass was above 1000°C, then crystals would be expected in the glass after heat treating at 1000°C for 24 hours.

All of the samples were submitted to ADS for XRD analysis. The results indicated that all of the glasses were amorphous (no crystals were present). Therefore, the liquidus temperature of these glasses would be expected to be below 1000°C. The results of this testing only apply to the two tested glass formulations. If a different frit composition is selected, additional testing with MST will be necessary.

Conclusions

MST (up to 1 wt% in the glass) does not appear to affect the crystallization of the sludge/CST glasses, even after heat treatment. Glasses with and without MST (at CST loadings of 5 or 10 wt%, and waste loadings of 26 wt% sludge oxides) were amorphous after heat treatment of 1000°C for 24 hours. This indicates that amorphous glasses can be produced when the DWPF limit of 1 wt% TiO₂ is exceeded.

Approvals

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