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INFLUENCE OF MELTING ACCELERATORS UPON THE GLASS BATCH STUDIED BY THERMAL ANALYSIS METHODS

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Most energy in glass industry is used at melting. From all energy consumption of a plant about 60-80% is usually consumed at glass melting depending on the character of the operation and type of manufacturing.

With regard to growing world energetic crisis, it is necessary for the melting process to be most economical. A few ways exist how to improve the melting process. The most advantageous at present seems to be the application of melting accelerators.

In this contribution is described the application of halogenide addition: i.e. the fluoride ion in the form of fluorite, and chloride ion in the form of sodium chloride. Fluoride and chloride ions were added to the glass batch in the following quantities /w%/: 0.5; 0.7; 0.9; 1.2%, and their mixtures in quantities: 0.25+0.25 and 0.45+0.45%.

Together with halogenides the 0.3% sodium sulphate was added as well to each sample.

METHODS AND RESULTS

The influence of halogenides upon melting, i.e. upon reaction in rigid state was evaluated by methods of differential thermal analysis, and thermogravimetry. Results of differential thermal analysis are introduced in Table 1, and results of thermogravimetry in Table 2.

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The course of DTA and TG curves with fluoride accelerators is presented in the Fig.1.

Records were made by equipment Derivatograph - the product of MOM Hungary

TABLE 1

Results of differential thermal analysis

Sample	Temperature at the peaks of endothermic signals				
	I.	II.	III.	IV.	V.
Original glass batch	103	308	610	810	900
Original glass batch + 0.5% F^-	120	310	590	750	840
Original glass batch + 0.7% F^-	120	300	600	730	820
Original glass batch + 0.9% F^-	120	317	600	730	825
Original glass batch + 1.2% F^-	115	300	588	715	808
Original glass batch + 0.5% Cl^-	120	300	590	735	820
Original glass batch + 0.7% Cl^-	120	300	600	730	825
Original glass batch + 0.9% Cl^-	120	300	590	715	820
Original glass batch + 1.2% Cl^-	120	300	590	710	820
Original glass batch + 0.25%F^- + 0.25%Cl^-	120	300	590	720	820
Original glass batch + 0.45%F^- + 0.45%Cl^-	120	300	590	710	820

TABLE 2

Results of thermogravimetry

Temperature /°C/	Original glass batch /mg/	F^- /mg/				Cl^- /mg/				$F^- + Cl^-$ /mg/	
		0.5	0.7	0.9	1.2	0.5	0.7	0.9	1.2	0.25 + 0.25	0.45 + 0.45
500	0	0	0	0	0	0	0	0	0	0	0
550	12	12	10	7	11	11	11	12	14	13	13
600	32	38	37	33	42	60	47	60	62	46	45
650	55	65	66	55	68	83	80	91	92	69	70
700	67	90	96	86	113	116	109	118	122	103	108
750	87	125	140	135	141	133	137	139	137	136	143
800	114	145	144	145	142	138	144	142	139	141	147
850	144	147	145	146	143	139	146	143	140	143	148
900	147	148	145	146	143	139	147	143	141	144	148

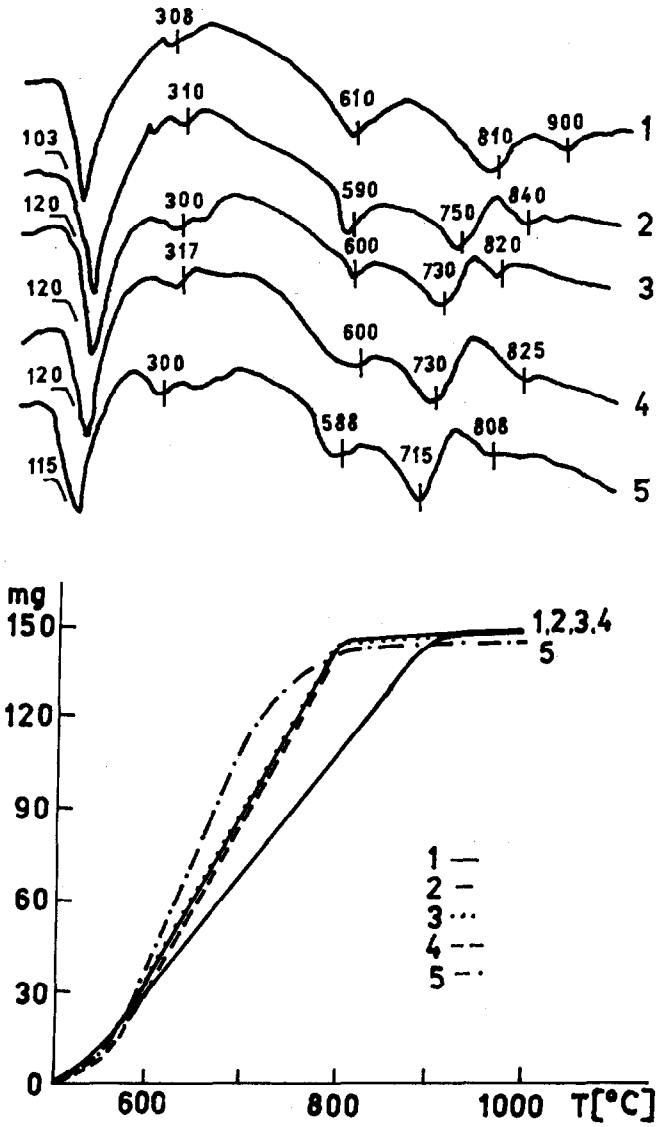

Fig.1: DTA and TG curves of glass batch with addition of the fluoride ions in the form of CaF_2

Curve 1 - original glass batch, curve 2 - original glass batch + 0.5% F^-, curve 3 - original glass batch + 0.7% F^-, curve 4 - original glass batch + 0.9% F^-, curve 5 - original glass batch + 1.2% F^-.
Similar course of curve can be seen when the chloride ion, or the mixture of fluoride and chloride ions was added.

DISCUSSION

In the DTA and TG curves the expressive influence of melting accelerators san be seen. But manifestation of this influence starts at the temperature interval 580-850 °C /i.e. at the third endothermic peak/. The first and the second endothermic peak works approximately equally in all samples.

The beginning of melting accelerators activity works in the third endothermic peak. In the fourth endothermic peak the expressive differences can be seen in the course of the reaction. In the original glass batch without melting accelerators the temperature of the endothermic reaction was 810 °C, and in the samples with addition of accelerators the mentioned value was lowered by 60 - 100 °C.

When evaluating the fifth endothermic peak, we came to the same conclusion. The temperature was similarly lowered by 60 - 92 °C. The area of the most intensive activity of melting accelerators was manifested in the TG curves as well in the form of weight decrease. This decrease was connected with decomposition of carbonate raw materials presented in the glass batch. The small decrease of weight at the beginning of heating was caused by dehydration.

In all thermic records when comparing the curve of glass batch without melting accelerators with these of glass batches to which accelerators were added a very good differentiation is evident.

On the basis of the experimental work mentioned, examination of the addition of melting accelerator was proposed during the experiments, and as a result an increase of production has occurred by ca 8%.

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