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THE INVESTIGATIONS OF THERMAL DECOMPOSITION PROCESS OF BASIC ALUMINIUM POTASSIUM SULFATE IN THE REDUCED CONDITIONS

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ABSTRACT

The dependence of the conversion degree on the time in the thermal decomposition process of basic aluminium potassium sulfate in the presence of carbon has been studied. By using RTG method the intermediates and finish products of reduction of burning compound have been identified.

INTRODUCTION

Thermal dissociation of basic luminium potassium sulfate leading to obtaine the aluminium oxide is the process which needs a lot of energy. For diminishing the energy has been examinated the possbility of the process realizing in reduced environment causing the diminish of the decomposition temperatures of investigated salts. The investigations start from thermogravimetric analysis of the indispensable quantity of the reductor and influence of temperature on the course of the process /1/. In this work the dependence of the conversion degree on the time for the thermal decomposition of basic aluminium potassium sulfate in the presence of carbon has been investigated.

RESULTS AND DISCUSSION

The series of experiments depending on the reduction of samples of basic aluminium potassium sulfate by means of black coal in the atmosphere of water vapour have been done. All reactions were made in the tube flow reactor at temperatures 610, 630, 650, 670 and 690 °C. At given temperature the reaction time was: 0.5; 1.0; 1.5; 2.0 and 2.5 hours. The solid products of the reduced decomposition of basic aluminium potassium sulfate at each time were submitted by means of derivatographic analysis and the contents of potassium oxide have been verified. The derivatographic analysis in addition of black coal (15 % w) have been done which permit to follow all possible stages of the decomposition of investigated compound. Comparing decreases of the mass (curve TG) during the dissociation of the solid product corresponding of removal from the investigated compound of the sulphur attached with aluminium and decrease of the mass for this same steps of the decomposition of raw material, the conversion degree in the investigated process have been determined. The experimental datum are presented in Fig. 1.

For the solid reaction products of the burning basic aluminium potassium sulphate the analysis of RTG have been done and results are presented in the Table 1. From the course of kinetic curves (Fig. 1) of reduction desulphuration of basic aluminium potassium sulphate gets the conclusion that for obtaining

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Table 1: Results of the RTG investigations of the reduced burning products

Samples: Z 620-2, Z 620-2.5, Z 630-2.5												
α-Al_2O_3			K_2SO_4			$KAl(SO_4)_2$			$K_3Al(SO_4)_3$			
d_{lit}	I	d_{exp}	d_{lit}	I	d_{exp}	d_{lit}	I	d_{exp}	d_{lit}	I	d_{exp}	
1	2	3	4	5	6	7	8	9	10	11	12	
			4.19	24	4.185	4.10	7	4.081	3.26	100	3.25	
			3.00	80	2.993	3.63	100	3.63	3.00	6	2.99	
			2.88	100	2.863	2.86	67	2.86	2.76	43	2.756	
			2.41	20	2.41	2.67	20	2.66	2.20	29	2.20	
			1.68	10	1.67	2.36	42	2.353	2.10	2	2.10	
			1.44	10	1.44	1.98	5	1.98				
			1.39	3	1.39	1.81	17	1.82				
						1.52	13	1.52				
						1.40	2	1.40				
Samples Z 640-2.5												
2.39	19	2.41	K_2SO_4			$KAl(SO_4)_2$			$K_3Al(SO_4)_3$			
1.975	72	1.97										
1.396	100	1.396	see above			see above			see above			
Samples: Z 630-3.5, Z 650-2, Z 650-2.5												
2.38	19	2.39	K_2SO_4									
1.975	72	1.97										
1.366	100	1.396	see above									
Samples: Z 670-2, Z 670-2.5												
2.39	19	2.39	4.19	24	4.17							
2.27	13	2.27	3.73	8	3.73							
			3.38	5	3.38							
1.975	72	1.97	3.00	80	3.00							
			2.88	100	2.88							
1.396	100	1.39	2.50	12	2.50							
			2.41	20	2.43							
			2.38	5	2.37							
			2.21	24	2.23							
			2.08	40	2.08							
			1.88	10	1.89							
			1.68	10	1.68							
			1.35	6	1.35							

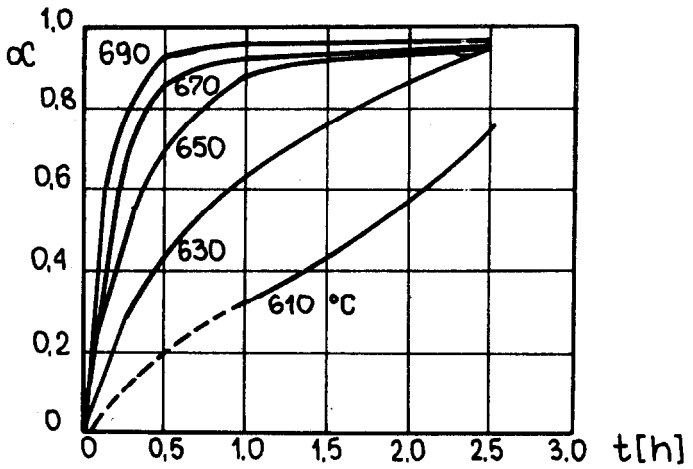

Fig. 1

mixture of aluminium oxide and potassium compounds a 1.5 h time is sufficient under the condition that the process will be provided at the range 650 to 700 °C. In all reaction products of the reduced decomposition K_2O are not identified, what can show, that in these conditions K_2O does not undergous of the decomposition. The X-ray analysis (Table 1) show, that the increasing of burning temperature without changing of the time causes the deepening of decomposition. In the sample which was burned 2.5 h, at the temperature 640 °C Z 640-2.5) except of K_2SO_4, $KAl(SO_4)_2$ and $K_3Al(SO_4)_3$, the $-Al_2O_3$ is appearenced. The X-ray spectrum of the samples burning at higher temperatures (670 °C, 2 to 2.5 h) show on the higher degree of the regularity of the crystalline structure. The prolongation of the time of burning at given temperature provides to the deepen of decomposition of investigated compound. The product as a result of the reduced burning of basic aluminium potassium sulphate at the temperature 630 °C, at 3.5 h time (Z 630-3.5) contains only the $-Al_2O_3$ and K_2SO_4 and it is identic with the product obtained at the temperature 650 °C at 2.5 h time. The X-ray spectrum of these two samples are identic.

REFERENCES

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