

THERMAL STUDY OF SULPHATE FORMATION DURING INTERACTION OF SULPHURIC ACID AND POLYSULPHIDE MATERIALS

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Abstract

On the basis of received thermal effects the interaction beginning of natural sulphide materials with sulphuric acid was found out and also activation energy and reaction order were calculated.

Methods of sulphide materials processing with the use of concentric sulphuric acid are known(1-3). But in those studies process of sulphite formation in the low temperature region during sulphide materials interaction with concentric sulphuric acid was not studied in detail.

The study of sulphate formation process will allow to substantiate the technology of hard to concentrate lean poly-metallic raw materials stripping(6). Experiments were carried out on the Hungarian Q- derivatograph.

The data of the Table 1 and of the Figures 1-2 show that interaction beginning of concentric sulphuric acid with Pb and Zn sulphides takes place in air flow at 40-32°C and in argon - at 50-55°C. Subsequent exothermic effects characterize the further sulphides oxidation and neogenic phase interaction.

Beginning of interaction of sulphuric acid and intermediate products is observed at 150-160°C.

Endothermic effects are connected with dehydration and dissociation of neogenic phases.

Interpretation of thermic effects made by us was also confirmed by the data of X-ray phase and crystalloptic analytical methods.

Calculated activation energies and reaction order are given in the Table 2.

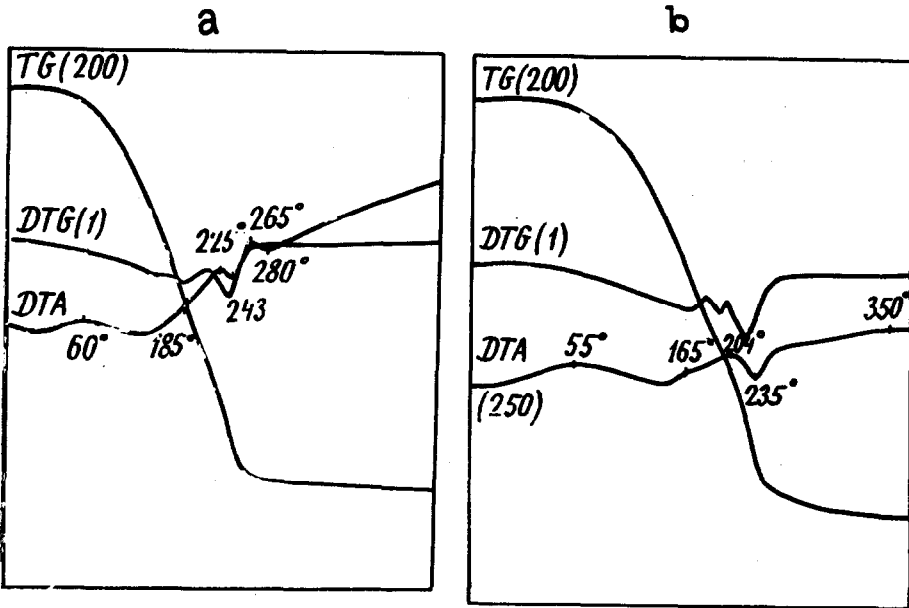


Fig.1. Heating curves of galena in the flow of a/air, b/argon.

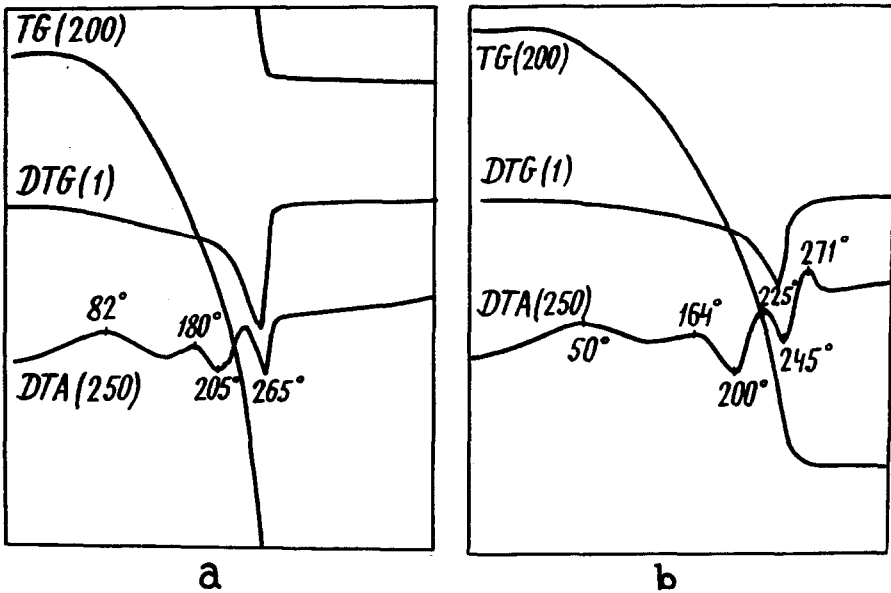


Fig.2. Heating curves of sphalerite in the flow of a/air, b/argon.

Table 1. DTA curves of minerals and intermediate products

Sample	Furnace heating rate °C/min	Thermal effects °C								Atmosphere
		exothermal			endothermal					
PbS	2,5	40	-	220	-	-	-	240	250	air
	5	60	135	225	265	-	-	243	-	
	10	-	-	240	-	472	-	-	-	
	20	-	115	250	-	-	-	-	-	
ZnS	2,5	60	-	225	-	-	128	200	245	
	5	32	130	235	-	-	205	218	265	
	10	-	100	-	-	-	230	283	300	
	20	-	100	-	-	-	200	239	292	
FeS ₂	2,5	-	-	-	-	-	-	245	-	
	10	-	133	300	375	420	-	250	-	
	5	-	-	-	-	434	217	250	-	
	20	-	160	-	-	500	-	250	300	
CuFeS ₂	2,5	-	140	-	-	460	210	217	-	
	5	73	-	-	-	-	210	217	260	
	10	-	140	300	359	-	225	259	303	
	20	-	150	-	-	460	210	217	-	
Intermediate product	5	-	152	260	-	-	134	206	300	
PbS	5	55	163	204	-	-	-	235	-	argon
ZnS	5	50	164	225	271	-	200	245	-	
FeS ₂	5	-	-	-	-	412	-	250	-	
CuFeS ₂	5	-	160	-	-	-	200	240	283	
Intermediate product	5	-	160	-	-	415	190	210	300	

Reaction rate maximum characterized by the value of $-T_s$ was defined according to experimental data of DTG curve. By projecting T_s peak on TG curve reaction order value n was defined.

Table 2. Activation energies and reaction order of minerals and intermediate products

Samples	Atmosphere					
	air			argon		
	T _s °K	E $\frac{\text{kJ}}{\text{mol}}$	n	T _s °K	E $\frac{\text{kJ}}{\text{mol}}$	n
PbS	423	46,9	0,3	439	26,9	0,35
	453	54,6	2	467	19,4	0,67
	494	82,8	1,5	493	77,7	2
ZnS	547	85,8	0,1	513	43,7	0,3
FeS ₂	401	37,4	0,5	523	16,3	0,25
CuFeS ₂	382	18,6	0,25	465	54,7	0,75
Intermediate product	457	69,5	0,33	461	42,3	0,5
	479	21,4	3	473	20,8	5
	557	284,3	0,5	543	81,7	3
	745	23,3	1	757	20,6	0,5

Energy activation calculation was made according to equation from the paper of Horowitz(7). Thus it was shown that in the low temperature range the interaction reaction of basic minerals of sulphide raw materials with sulphuric acid in the air atmosphere took place in the kinetic region.

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