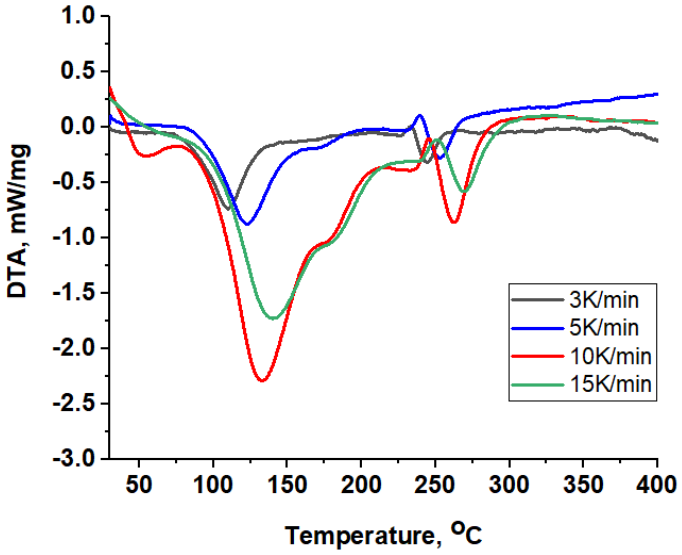
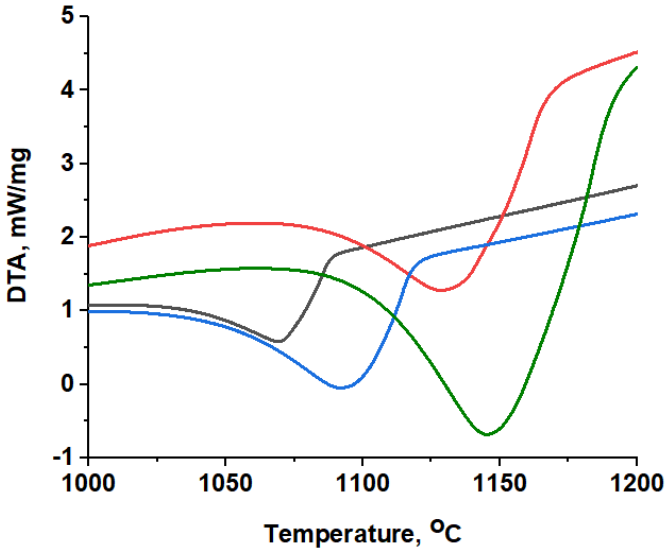
Supplementary materials



a)



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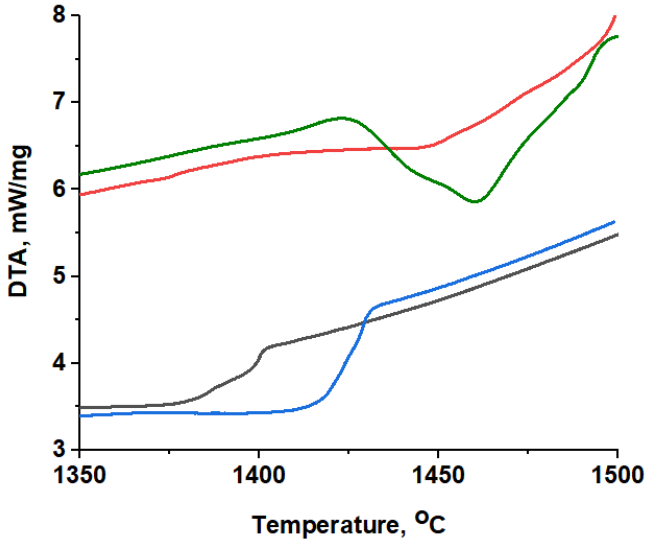

c)

Figure S1. Heat effect showing up in dependence of heating rate for processes of destruction of lanthanum sulfates: a – signals A–D, b – signal E, c – signal F

Table S1. Fractional atomic coordinates and isotropic displacement parameters (Å^2) of β-$La_2(SO_4)_3$

	x	*y*	*z*	B_{iso}
La	0.14997 (9)	0.0946 (3)	0.0342 (2)	0.3 (1)
S1	0.3034 (4)	0.1002 (16)	0.3066 (9)	2.2 (2)
S2	0	-0.080 (2)	0.25	2.2 (2)
O1	0.0744 (8)	0.0205 (17)	0.2442 (15)	1.5 (2)
O2	-0.0248 (8)	-0.178 (2)	0.0808 (17)	1.5 (2)
O4	0.3448 (7)	-0.069 (3)	0.3315 (15)	1.5 (2)
O3	0.2171 (9)	0.054 (2)	0.3111 (14)	1.5 (2)
O6	0.3399 (9)	0.261 (2)	0.419 (2)	1.5 (2)
O5	0.2927 (7)	0.162 (2)	0.1137 (17)	1.5 (2)

Table S2. Main bond lengths (Å) of β-$La_2(SO_4)_3$

La—O1	2.451 (12)	S1—O4	1.38 (2)
La—O1^{i}	2.681 (12)	S1—O3	1.566 (14)
La—O2^{ii}	2.324 (12)	S1—O6	1.524 (19)
La—O4^{iii}	2.579 (19)	S1—O5	1.654 (16)
La—O3	2.431 (12)	S2—O1	1.495 (14)
La—O3^{i}	2.602 (13)	S2—O2	1.567 (16)
La—O6^{iv}	2.339 (17)	–	–
La—O5	2.537 (10)	–	–
La—O5^{v}	2.418 (13)	–	–

Symmetry codes: (i) *x*, -*y*, *z*-1/2; (ii) -*x*, -*y*, -*z*; (iii) -*x*+1/2, *y*+1/2, -*z*+1/2; (iv) -*x*+1/2, *y*-1/2, -*z*+1/2; (v) -*x*+1/2, -*y*+1/2, -*z*

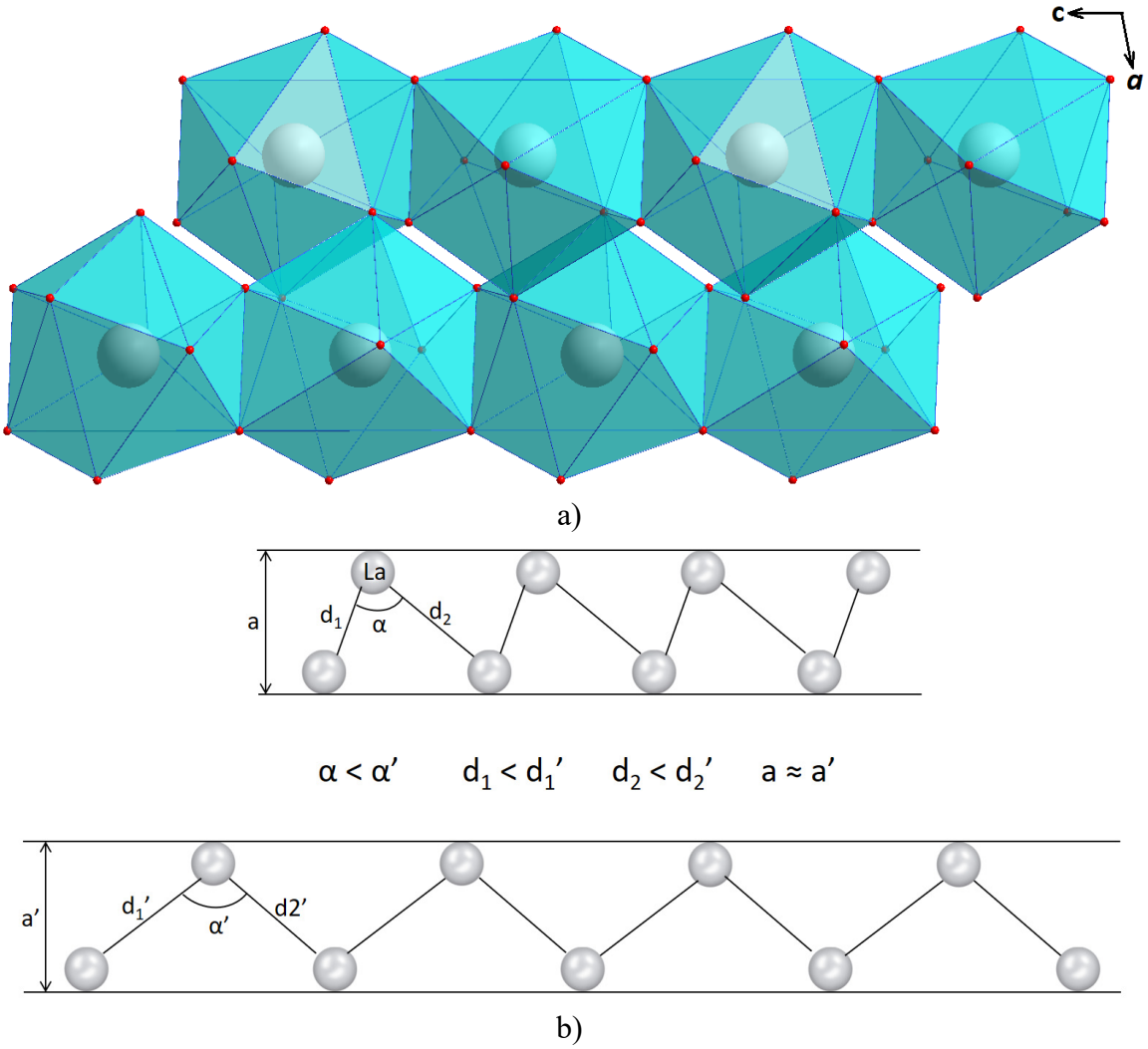

Figure S2. Chain structure of LaO_9 polyhedra (a) and proposed mechanism of zero thermal expansion in the β-$La_2(SO_4)_3$ structure (b)

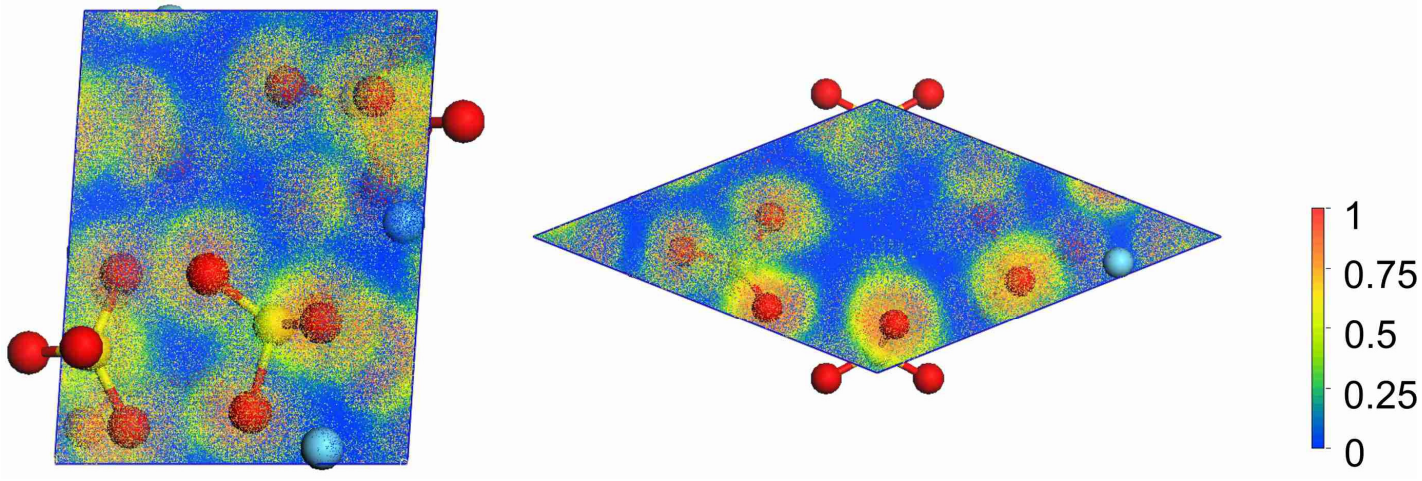

Figure S3. Electron localization function in β-$La_2(SO_4)_3$ calculated using local density approximation.

Table S3. Main parameters of processing and refinement of the $La_2(SO_4)_3 \cdot 9H_2O$ sample

Sp. Gr.	$P6_3/m$
a (Å)	11.029515(60)
c (Å)	8.104587(77)
V (Å^3)	853.836(12)
Z	2
2θ-interval, º	10-90
R_{wp} ,%	6.52
R_p ,%	4.43
χ^2	2.07
R_B ,%	5.1

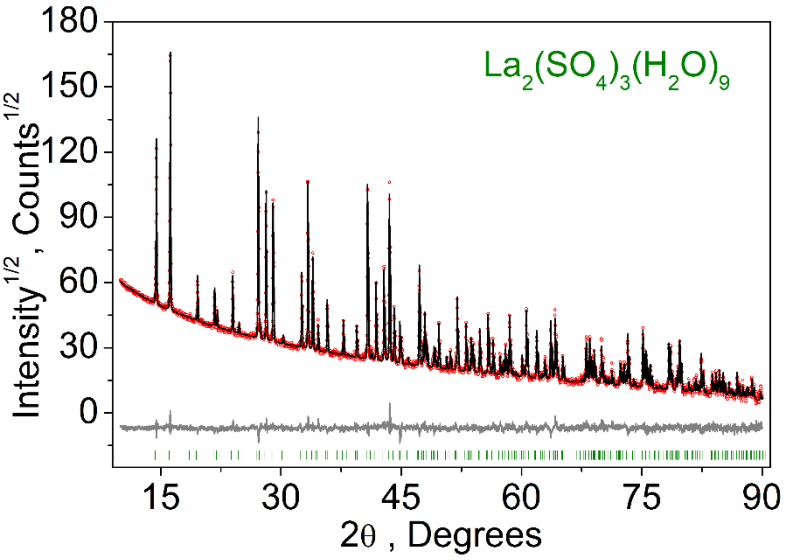

Figure S4. Difference Rietveld plot of the $La_2(SO_4)_3 \cdot 9H_2O$ compound