

## THE TWINNING STRUCTURE OF TRIDYMITE FROM MIAROLITIC DACITE OF THE CHERNA MOUNTAIN (TRANSCARPATHIANS, UKRAINE)

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The alkali feldspars (sanidine, anorthoclase) and tridymite are the main high-temperature phases which crystallised in miarolitic dacites (KVASNITZA *et al.*, 1987). Transparent tabular crystals of tridymite represented an excellent object for X-ray (Laue and oscillation photographs) and light optical investigation. On the basis of cell dimensions three types of tridymite crystals have been discovered: 1.  $a = 51.83 \text{ \AA}$ ,  $b = 29.99 \text{ \AA}$ ,  $c = 49.2 \text{ \AA}$ ; 2.  $a = 25.83 \text{ \AA}$ ,  $b = 5.0 \text{ \AA}$ ,  $c = 49.2 \text{ \AA}$ ; 3.  $a = 17.22 \text{ \AA}$ ,  $b = 9.93 \text{ \AA}$ ,  $c = 40.91 \text{ \AA}$ . The Laue photographs of the first type of crystals show  $6/mmm$  diffraction symmetry. Three different optical domains are displayed. The symmetry of the twin domain is pseudo-orthorhombic. The cell dimensions of the twinned crystal correspond to the superstructure based on the monoclinic cell of MC-tridymite (TAGAI *et al.*, 1977). The domain structure arises from pseudo-hexagonal twinning of the monoclinic cell. The twin domains are related to each other by a  $60^\circ$  rotation about  $[-201]$ . When only one domain in the crystal exists, the superstructure along the  $b$  axis disappears. That is the second type of tridymite crystals. The cell dimensions of the third type crystals correspond to a pseudo-orthorhombic tridymite OP-5 (NIKUI & FLÖRKE, 1987).

Two different morphologic varieties of the domain boundaries exist in twinned tridymite. 1. Serrated (or saw-like) boundaries are dominant. Their orientation in most cases conforms to  $\{11-20\}$  plane. The "teeth" of twin boundaries formed on the intersection of  $\{10-10\}$  and  $\{11-20\}$  planes. 2. The thin polysynthetic twins on serrated boundaries are rarely observed. The straight and narrow twin domains originate from saw "teeth" and then rapidly disappear when they move off from the boundary. The pseudo-

morph replacement of quartz by tridymite is an evidence that tridymite crystallised above  $867^\circ\text{C}$ . It is known (CARPENTER *et al.*, 1998), that tridymite structure undergoes phase transition ( $P6_322 \rightarrow C222_1$ ) below  $353^\circ\text{C}$ . It is suggested that subsequent transformation into monoclinic structure ( $< 180^\circ\text{C}$ ) also accompanied twinning. Then, the transformations at  $353^\circ\text{C}$  and  $< 180^\circ\text{C}$  may be the reason of the pseudo-hexagonal and polysynthetic twinning. Below inversion point the domain size was small, but during the subsequent rock cooling the enlargement of the twin structure occurred. The following observations are the evidence of that. 1. The fraction of the large domains in domain size distribution is predominant. 2. The twin domain system is unbalanced because only one of the three possible oriented domains is predominant. 3. During domain enlargement, a reorientation of twin boundaries takes place. It should be noted that sanidine coexisting with tridymite is not only untwinned but does not even show indications of exsolution. This suggests that the enlargement of tridymite twin domains was not realised by a diffusion mechanism.

### References

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