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Krátké původní sdělení

CRYSTALLIZATION OF $Rb_2O \cdot B_2O_3 \cdot 4\,SiO_2$

(Preliminary communication)

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The paper is concerned with the ternary compound $Rb_2O \cdot B_2O_3 \cdot 4SiO_2$ *which is precipitated during crystallization of glasses of suitable compositions in the system* Rb_2O—B_2O_3—SiO_2. *This ternary phase analogous to boroleucite or leucite crystallizes in the cubic system with lattice parameter* $a = 12.78 \times 10^{-10}$ m.

In a previous study [1] boroleucite $Rb_2O \cdot B_2O_3 \cdot 4\,SiO_2$ was found to precipitate during crystallization of glass. This has later been confirmed by the studies by M. Ihara and F. Kamei [2] on the structure of this compound. We were further interested whether the crystallization in the system Rb_2O—B_2O_3—SiO_2 also results in precipitation of a ternary phase similar to boroleucite.

A small amount of glass at the approximately stoichiometric composition $Rb_2O \cdot B_2O_3 \cdot 4\,SiO_2$ was melted (Table I). The glass was melted from chemically pure materials after previous batch sintering (700 °C) in a PtRh crucible. The glass was melted at 1600 °C and refined within 55 minutes. Since volatilization of batch components could not be ruled out, a chemical analysis of glass was performed (Table I).

Table I
The composition of rubidium borosilicate glass (wt. %)

Oxides	Rb_2O	B_2O_3	SiO_2	Σ
Initial composition	37.6	14.05	48.35	100.00
Melted glass	32.2	13.8	54.05	100.05
Difference	—5.4	—0.25	+5.7	

The results indicate that in the melted glass the Rb_2O content distinctly decreased in favour of SiO_2 so that the stoichiometric ratio $Rb_2O : SiO_2 = 1 : 4$ could not be maintained.

The glass was submitted to gradient crystallization within the temperature range of 820—1100 °C for a period of 6 hours. It has been found that the crystallization

takes place from temperatures of about 960 °C up to the almost highest one. However, visually the crystallization degree is distinctly lower than e.g. that of boroleucite.

As in the case of boroleucite, X-ray investigations were carried out on the basis of powder diffraction patterns using the Guinier de Wolff chamber XDC-700 and the CuK_α radiation. On the assumption that the precipitated phase has a cubic symmetry similar to that of boroleucite, the diffraction lines d have been ascribed indices hkl and the lattice parameter determined was $a = 12.78 \times 10^{-10}$ m.

The further five diffraction lines correspond to the main lines of low-temperature quartz (according to ASTM 5-0490) [3]. This result could be expected (due to the excess of SiO_2 found by chemical analysis). The measured and calculated values of lines d for the compound $Rb_2O \cdot B_2O_3 \cdot 4\,SiO_2$, together with the respective indices hkl, are listed in Table II together with the hkl indices of low-temperature quartz.

The very satisfactory agreement between the measured and the calculated values (in most instances $\Delta d \leqq 0.001$) indicates that the substance is actually an analogy of boroleucite.

Table II

A comparison of the mesured d-values of crystallized rubidium borosilicate glass containing low-temperature quartz, and the assumed compound $Rb_2O \cdot B_2O_3 \cdot 4\,SiO_2$

Rubidium borosilicate glass			Low-temperature quartz (ASTM-5-0490)		$Rb_2O \cdot B_2O_3 \cdot 4\,SiO_2$		
No.	d_{exp}	I/I_0	d	I/I_0	$d_{cal.}$	Δd	hkl
1	5.21	10			5.217	+0.007	211
2	4.696	10					
3	4.258	20	4.26	35			
4	3.961	10					
5	3.769	10					
6	3.415	90			3.416	+0.001	321
7	3.347	80	3.343	100			
8	3.195	100			3.195	0.000	400
9	3.049	10					
10	2.725	70			2.725	0.000	332
11	2.610	10			2.609	—0.001	422
12	2.507	20			2.506	—0.001	431 (510)
13	2.333	20			2.333	0.000	521
14	2.259	50			2.259	0.000	440
15	2.193	20			2.192	—0.001	433 (530)
16	2.072	50			2.073	+0.001	532 (611)
17	1.885	20			1.884	—0.001	631
18	1.819	30	1.817	17			
19	1.739	40			1.739	0.000	552 (633, 721)
20	1.672	10	1.672	7			
21	1.665	20			1.664	—0.001	731
22	1.623	50			1.623	0.000	651 (732)
23	1.597	10			1.597	0.000	800
24	1.543	10	1.541	15			
25	1.486	20			1.486	0.000	743 (750, 831)
26	1.447	20			1.447	0.000	752
27	1.429	20			1.429	0.000	840
28	1.340	20			1.340	0.000	931
29	1.318	10			1.318	0.000	763 (932)
30	1.265	10			1.265	0.000	772 (1011)

References

[1] Voldán J.: Silikáty *23*, 133, 1979.
[2] Ihara M., Kamei F.: J. Ceram. Soc. Japan *88*, 32, 1980.
[3] Swason Fuyat, NBS Circular, Vol. III, p. 539, 1953 — (ASTM 5-0490).

КРИСТАЛЛИЗАЦИЯ Rb_2O . B_2O_3 . 4 SiO_2

(Предварительное сообщение)

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С целью проверить, выделяется ли аналогичное соединение боролейцита при кристаллизации стекол в системе Rb_2O—B_2O_3—SiO_2, варили небольшое количество стекла, приближающегося к стехиометрическому составу Rb_2O . B_2O_3 . 4 SiO_2 (табл. I).

Рентгеновским фазовым исследованием закристаллизовавшихся проб (камера Гинье-де-Вольффа XDC-700 фирмы Нониус, излучение CuK_α) было установлено, что выделяется небольшая доля низкотемпературного кварца (согласно ASTM-5-0490) и значительная доля неизвестной фазы (табл. II).

При предположении, что речь идет о кубической симметрии данной фазы аналогичной боролейциту, удалось провести координацию с *d*-линиями показателями *hkl* и был установлен параметр решетки $a = 12{,}78 \cdot 10^{-10}$ м.

Весьма хорошее совпадение измеренных и рассчитанных величин ($\Delta d = 0{,}001$) является свидетельством того, что действительно речь идет о аналогии боролейцита, или лейцита.

KRYSTALIZACE Rb_2O . B_2O_3 . 4SiO_2

(Předběžné sdělení)

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Ve snaze ověřit, zda se vylučuje analogická sloučenina boroleucitu při krystalizaci skel v soustavě Rb_2O—B_2O_3—SiO_2, bylo utaveno malé množství skla, blížícího se stechiometrickému složení Rb_2O . B_2O_3 . 4 SiO_2 (tab. I).

Rtg fázovým výzkumem zkrystalovaných vzorků (Guinier de Wolffova komora XDC-700 od fy Nonius, záření CuK_α) bylo zjištěno, že se vylučuje malý podíl nízkoteplotního křemene (podle ASTM-5-0490) a značný podíl neznámé fáze (tab. II).

Za předpokladu, že jde o kubickou symetrii této fáze obdobné boroleucitu, se podařilo přiřadit *d*-liniím indexy *hkl* a byl stanoven mřížkový parametr $a = 12{,}78 \cdot 10^{-10}$ m.

Velmi dobrá shoda naměřených a vypočtených hodnot ($\Delta d \leqq 0{,}001$) svědčí o tom, že skutečně jde o analogii boroleucitu, popř. leucitu.