

Starting Materials

Naturally occurring kyanite and andalusite from Minas Gerais, Brazil, and sillimanite from Dillon, Montana, were used. The specimens were examined optically and found to be free of other phases. A chemical analysis for the kyanite sample is currently being made.

A few runs using mechanical mixtures of kaolinite and a synthetic aluminum trihydrate and some additional runs using previously described gels were also made.

Identification of Samples

In addition to the usual x-ray techniques and the transmitted polarized light methods of identification, all runs are also being examined by reflected light in polished section in order to see the microstructural relationships of the phases. This has proved to be a very sensitive technique for observing the beginning stages of the changes taking place. Identification still requires the combination of all the techniques.

RESULTS AND DISCUSSION

The data are summarized in Tables II through IV and are shown graphically in Figs. 3 and 4.

More data are needed to firmly establish the kyanite decomposition curve shown as the heavy dashed line in Fig. 3, but the general trend is clear. At one atmosphere, decomposition was observed in 48 hours at about 1100°C. This is in agreement with the work of Greig.⁽³⁾ Clark *et al.*⁽¹⁾ report no decomposition of kyanite at 1000°C in 4 days at 1 atm. At 1500°C and 45,000 atm, kyanite is stable while decomposition is observed at the same temperature at 35,000 atm. Other data consistent with the curve determined from kyanite are the partial conversion of sillimanite to kyanite at 1700°C and 50,000 atm and the synthesis of kyanite from a gel at 50,000 atm in the temperature range 1500° to 1800°C. Kyanite has also been synthesized from a gel at 20,000 atm and about 1200°C, but not reproducibly, and there is some doubt as to the temperature of the successful run.

3. J.W. Greig, J. Am. Ceram. Soc., 8 (8), 465-484 (1925).

TABLE II
Results of Experiments with Kyanite

Run No.	Starting Material	Temp (°C)	Pressure (atm) x 10 ³	Time (min)	Heater	Phases Present and Remarks
1624	Ky*	1850	30	4	G†	Mullite, corundum, glass‡
1634	Ky	1830	50	10	G	Kyanite beginning to decompose, some glass and corundum at grain boundaries
1641	Ky	1820	20	10	G	Mullite, glass
1642	Ky	1790	40	5	G	Kyanite decomposing at grain boundaries, some glass and corundum
1648	Ky	1530	25	45	G	Mullite, glass, corundum at grain boundaries of original kyanite
1649	Ky	1500	30	35	G	Mullite, undecomposed kyanite, glass
1652	Ky	1850	45	10	G	Kyanite decomposition evident, glass and corundum at grain boundaries
1653	Ky	1500	35	13	G	Kyanite decomposition uncertain
1654	Ky	1950	50	10	G	Kyanite, considerable decomposition, mullite, corundum, glass
1655	Ky	1720	35	10	G	Kyanite decomposition, corundum and glass at grain boundaries
1656	Ky	1350	30	15	G	Kyanite decomposition uncertain
1657	Ky	1320	20	15	G	Mullite, some undecomposed kyanite, glass, corundum (?)
1659	Ky	1910	45	10	G	Considerable decomposition of kyanite; mullite, glass, corundum at grain boundaries
1674	Ky	1500	45	30	G	Kyanite
1675	Ky	1300	15	30	G	Mullite, corundum, glass

*Ky = Kyanite

†G = Graphite

‡Glass or material amorphous to x-rays.