

Sillicates

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The System Al_2SiO_5 at High Temperatures and Pressures

by R. C. DeVRIES

Research Laboratory, General Electric Company, Schenectady, New York

Experiments on the system Al_2SiO_5 at high temperatures and pressures with the belt apparatus indicate that kyanite melts incongruently above about 1500°C at 25,000 bars to Al_2O_3 (corundum) plus liquid. The pressure-temperature curves obtained by starting with either a 1/1 $\text{Al}_2\text{O}_3/\text{SiO}_2$ gel or with kyanite are essentially identical but differ considerably from the results with andalusite and sillimanite. The structure of the starting material has considerable influence on the kinetics of the reaction and the metastable formation of corundum in this system. An "equilibrium" curve based on the andalusite-sillimanite data is described by $P = 33.8 \times 10^{-3} T - 26.4$ (P in kbars, T in $^\circ\text{C}$).

I. Introduction

THE geological significance of pressure-temperature relations among the three forms of Al_2SiO_5 (sillimanite, andalusite, and kyanite) has stimulated several experimental investigations. The kyanite-sillimanite relations up to 1500°C and 30,000 bars have been determined by Clark,

Robertson, and Birch¹ and have been redetermined by Clark,² Kennedy³ and Griggs and Kennedy⁴ have published studies related to the same problem. The synthesis of andalusite

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At the time this work was done, the writer was mineralogist, Ceramic Studies Section, Metallurgy and Ceramics Research Department, Research Laboratory, General Electric Company. He is now associate professor, Department of Materials Engineering, Rensselaer Polytechnic Institute, Troy, N. Y.

¹ S. P. Clark, Jr., E. C. Robertson, and Francis Birch, "Experimental Determination of Kyanite-Sillimanite Equilibrium Relations at High Temperatures and Pressures," *Am. J. Sci.*, **255** [9] 628-40 (1957).

² S. P. Clark, Jr., "Redetermination of Equilibrium Relations Between Kyanite and Sillimanite," *Am. J. Sci.*, **259** [9] 641-50 (1961); *Ceram. Abstr.*, 1962, June, p. 153i.

³ G. C. Kennedy, "Pyrophyllite-Sillimanite-Mullite Equilibrium Relations to 20,000 Bars and 800°C ," *Bull. Geol. Soc. Am.*, **66**, 1584 (November 1955) (abstract).

⁴ D. T. Griggs and G. C. Kennedy, "Simple Apparatus for High Pressures and Temperatures," *Am. J. Sci.*, **254** [12] 722-35 (1956).