the iron capsules by a thin plate of synthetic mica. Thermocouple leads were brought out to the faces of the pair of anvils not used for the graphite furnace contacts. The run temperatures were corrected for the increase of surface temperature of the tungsten carbide anvils. In each run no correction was made for the effect of pressure on the emf of the thermocouple. No significant change in the emf of the thermocouple with time was detected when the run time was held to 5 min in the runs at a temperature below 1500°C. This may indicate that a fatal contamination of the thermocouple by the various furnace inserts or the capsule material did not occur. However, the rate of thermocouple contamination undoubtedly increases with temperature. For this reason, run time in the range 1500 to 1700°C was reduced to 4 or 3 min.

The temperature gradient within the graphite furnace containing the iron capsule was measured by inserting two sets of thermocouples within the furnace space, one in the place shown in Figure 1*a* and the other in the upper surface of the BN spacers, 0.2 mm thick, which separate the iron capsule from the upper pyrophyllite disk. A precision of temperature measurement of ±20°C was obtained at temperatures as high as 1500°C. The temperature gradients within the furnace assembly such as shown in Figure 1*b* have already been reported [*Akimoto et al.*, 1965]. Satisfactory temperature distribution was obtained by the reduction of the sample space.

A single-stage piston cylinder type of high-pressure apparatus was used for three runs at 17 kb. The furnace and thermocouple assemblies, which are essentially similar to those described by *Boyd and England* [1963], were used for these runs.

Starting materials. Fayalite, used as the starting compound for all the phase-equilibrium experiments reported in this paper, was microcrystalline Fe_2SiO_4 prepared by Katsura and Kitayama from wüstite and silica. Details of the synthesis were given in a previous publication [*Akimoto and Fujisawa*, 1965]. The starting compound was established by means of microscopic observation and X-ray diffraction to be a single-phase material with olivine structure.

Determination of the melting curve and the olivine-spinel transition curve. The quenching method used in determining the melting curve of Fe_2SiO_4 was essentially the same as that used for forsterite [*Davis and England*, 1964]. Fayalite samples were brought to desired temperatures at constant pressure over an interval of 4 to 6 min, held at the desired temperatures for 3 to 5 min, and quenched isobarically. Most of the reaction products were examined under the microscope. The X-ray diffraction method was also used to ensure the absence of contamination.

The olivine-spinel transition curve of Fe_2SiO_4 was determined by the same method as described previously [*Akimoto et al.*, 1965]. Reactions from olivine to spinel and from spinel to olivine were examined.

Experimental Results

Results of quenching runs upon which the melting curve and the olivine-spinel transition curve of Fe_2SiO_4 are based are summarized in Table 1.

Usually liquid of fayalite composition could not be quenched to room temperature, but melting could easily be detected by a difference in texture between runs which had crystallized from liquid during the quench and those which had recrystallized below the melting curve. Fayalite which had recrystallized without melting was granular, whereas that formed from liquid upon quenching had fibrous or lamellar textures, both of which are typical features of quench crystals. In several runs, both quench crystals and recrystallized crystals coexisted in the run products. This may be caused by a combination of thermal gradient along the sample space and temperature fluctuation during the run. Results obtained with various types of cell assembly described earlier have been cross-checked, and no significant difference has been found except for the runs above 1500°C with iron capsule and boron nitride furnace inserts. Glass and coesite crystals produced in two runs entered the liquid region of this furnace assembly. This may suggest that boron nitride inserts reacted with the fayalite sample through the iron capsule at temperatures above 1500°C. It is safely concluded from the data listed in Table 1 that fayalite melts congruently at pressures up to about 62 kb. The melting curve of fayalite shown in Figure 2

TABLE 1. Melting and Olivine-Spinel Transition of Fe_2SiO_4

Starting* Material	Pressure,† kb	Temperature, °C	Time, min	Furnace Assembly‡	Results
A	17.0	1225 ± 5§	5	Fe(I)	Fayalite crystals
A	17.0	1275 ± 5	5	Fe(I)	Fayalite crystals
A	17.0	1315 ± 5	5	Fe(I)	50% fayalite crystals + 50% fayalite quench crystals
A	28.0	1340 ± 5	5	Fe(I)	Fayalite crystals
A	28.0	1400 ± 5	5	Fe(I)	Fayalite quench crystals
A	30.0	1390 ± 5	5	Fe(II)	Fayalite crystals
A	30.0	1415 ± 10	5	Fe(II)	60% fayalite crystals + 40% fayalite quench crystals
A	31.0	1345 ± 10	5	Fe(II)	Fayalite crystals
A	36.5	755 ± 10	120	Fe(III)	Fayalite crystals
A	40.5	755 ± 5	120	Fe(III)	Fayalite crystals
A	42.5	875 ± 5	45	Fe(III)	Fayalite crystals
A	44.0	755 ± 10	120	Fe(III)	Fayalite crystals + spinel crystals (small amount)
A	45.0	1415 ± 5	5	Fe(II)	Fayalite crystals
A	45.0	1455 ± 5	5	Fe(II)	70% fayalite crystals + 30% fayalite quench crystals
A	45.0	1475 ± 10	5	Fe(II)	10% fayalite crystals + 90% fayalite quench crystals
A	45.5	880 ± 10	45	Fe(III)	Fayalite crystals
A	45.5	1020 ± 10	20	Fe(III)	Fayalite crystals
A	46.0 ± 1.0	755 ± 10	120	Fe(III)	Spinel crystals
A	48.5	1020 ± 10	20	Fe(III)	Fayalite crystals
A	49.5	870 ± 10	45	Fe(III)	80% spinel crystals + 20% fayalite crystals
A	52.0	1025 ± 15	30	Fe(III)	Spinel crystals
B	52.0	1145 ± 10	15	Fe(III)	Fayalite crystals
A	54.5	1025 ± 10	20	Fe(III)	Spinel crystals
A	55.0	1180 ± 10	10	Fe(III)	Fayalite crystals
A	55.0	1480 ± 5	5	Fe(I)	Fayalite crystals
A	55.0	1515 ± 5	5	Fe(I)	Glass + coesite
A	56.0	1205 ± 5	12	C	Fayalite crystals
A	56.0	1400 ± 5	5	C	Fayalite crystals
B	57.0	1110 ± 10	15	Fe(III)	Spinel crystals
A	57.0	1165 ± 15	10	Fe(III)	Fayalite crystals
A	57.0	1380 ± 5	5	Fe(III)	Fayalite crystals
A	58.0	1170 ± 10	10	Fe(III)	60% spinel crystals + 40% fayalite crystals
B	58.0	1355 ± 5	10	Fe(III)	Fayalite crystals
A	58.0	1505 ± 10	5	C	20% fayalite crystals + 80% fayalite quench crystals
A	58.0	1555 ± 10	4	C	Fayalite quench crystals
A	58.5	1375 ± 5	5	Fe(III)	Fayalite crystals
B	60.0	1320 ± 5	10	Fe(III)	Fayalite crystals
A	60.0	1480 ± 5	5	Fe(I)	Fayalite crystals
A	60.0	1530 ± 5	5	Fe(I)	Glass + coesite
A	60.0	1555 ± 5	5	Fe(IV)	Fayalite quench crystals + garnet ?
A	61.0 ± 1.0	1300 ± 5	10	C	70% fayalite crystals + 30% spinel crystals
A	61.5	1205 ± 5	12	C	Spinel crystals + fayalite crystals (small amount)
A	61.5	1400 ± 10	5	C	Fayalite crystals
A	62.0	1485 ± 5	5	C	80% spinel crystals + 20% fayalite crystals
A	62.0	1535 ± 5	4	Fe(IV)	Fayalite quench crystals + garnet ?
A	63.0	1340 ± 5	10	C	80% spinel crystals + 20% fayalite crystals