under 100,000 atm and atmospheric pressure to further investigate the system. Chemical analysis of these compositions showed them to contain 0.01 per cent carbon, which is lower than the 0.03 per cent carbon materials previously employed.

Metallographic examination of these compositions showed essentially the same structures noted in the previous compositions. All the pressure-treated samples exhibited a pseudo-martensitic structure, and the conventionally treated samples showed a large-grained, single-phase structure, although the 0.25 per cent aluminum control did possess the more refined grain size as previously noted in the 0.5 per cent aluminum control. However, the 0.25 per cent aluminum control (Fig. 7) still did not have the martensitic structure that is believed to be indicative of the austenite to ferrite transformation.

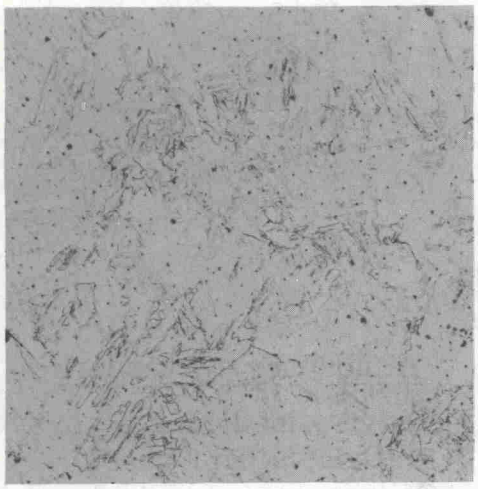

Fig. 6 Iron-(2 wt per cent aluminum). Quenched after holding at 1150°C, 100,000 atm. Etch: 2 per cent Nital. 100X

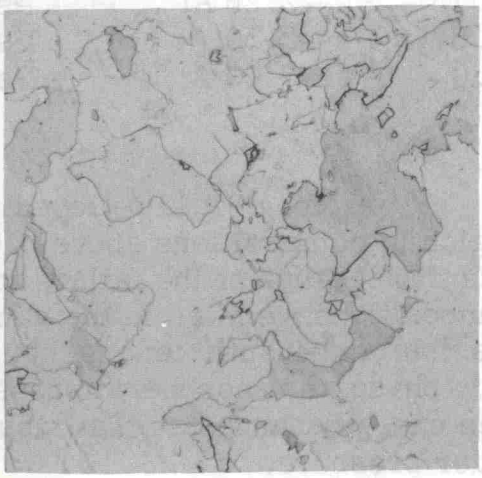

Fig. 7 Iron-(0.25 wt per cent aluminum). Quenched after holding for 30 minutes at 1150°C, atmospheric pressure. Etch: 2 per cent Nital. 100X

Hardness measurements, as listed below, indicated a consistently higher hardness in all pressure-treated specimens, which might be taken as an indication of the formation of a martensite-type phase. Moreover, the hardness of the 0.25 per cent aluminum control was higher than the other control compositions which might be an indication of incipient martensite formation.

Rockwell "A" Hardness Values of Iron-Aluminum Specimens Prepared at Atmospheric Pressure and at 100,000 Atm

		100,000 Atm	Atmospheric Pressure
99.75	Fe--0.25 Al	56.0 R_A	37.0 R_A
99.5	Fe--0.5 Al	56.0	27.8
99.0	Fe--1.0 Al	55.5	29.0
98.0	Fe--2.0 Al	56.0	31.5
97.75	Fe--2.25 Al	57.0	35.0
97.5	Fe--2.50 Al	56.0	36.0
97.0	Fe--3.00 Al	56.0	38.0

Observed Microstructures Iron-Aluminum System

Composition (wt %)		100,000 Atm	Atmospheric Pressure
99.75	Fe--0.25 Al	Pseudo-martensitic	Very refined, single-phase
99.50	Fe--0.5 Al	Pseudo-martensitic	Refined, single-phase
99.0	Fe--1.0 Al	Pseudo-martensitic	Coarse-grained, single-phase
98.0	Fe--2.0 Al	Pseudo-martensitic	Coarse-grained, single-phase
97.75	Fe--2.25 Al	Pseudo-martensitic	Coarse-grained, single-phase
97.5	Fe--2.50 Al	Pseudo-martensitic	Coarse-grained, single-phase
97.0	Fe--3.00 Al	Pseudo-martensitic	Coarse-grained, single-phase

Although it is believed that pressure has shifted the gamma loop region to compositions above 3.0 per cent aluminum, conclusions may be doubtful because of the failure to produce the pseudo-martensitic phase in compositions well within the gamma loop at atmospheric pressures. It is possible that insufficient carbon was present to retain the metastable martensitic phase at atmospheric pressure, and that pressure had some effect on free energy changes so that a pseudo-martensitic phase could be stabilized under pressure.