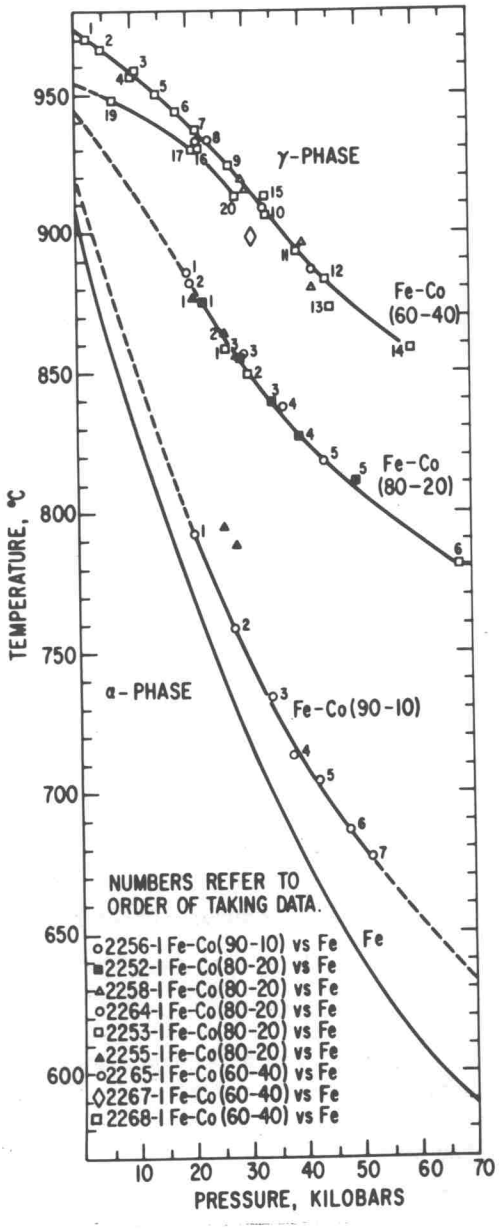

Fig. 9 P-T plots for α - γ transformations in Fe Co alloys. Average temperature curves

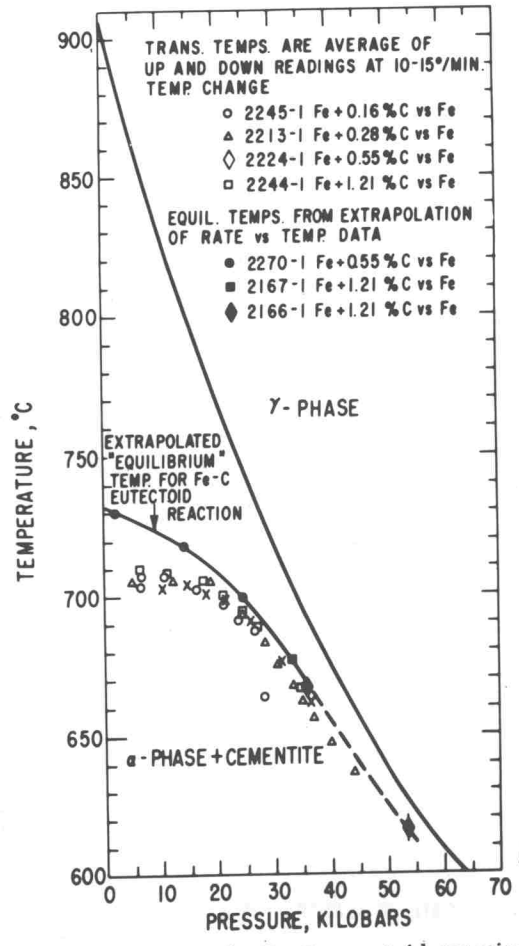

Fig. 10 P-T plots for Fe-C eutectoid reaction

in the same run (2268-1), when, after going up to 60 kb in a series of steps, the pressure was lowered to 20 kb; the value for the transformation now appeared 8 deg lower than originally at this pressure. Lowering the pressure still further resulted in an extrapolated value at atmospheric pressure about 20 deg lower than observed at the beginning of the run. Since this was a fairly long run involving many passes through the α-γ transformation, it is very likely that this shift is due to deterioration in the chromel-alumel thermocouple.

(f) The Fe-C Eutectoid Reaction. Four Fe-C alloys, containing 0.16, 0.28, 0.55 and 1.21 percent carbon, respectively, were studied by the duplex DTCA technique. The P-T plots presented in Fig.10 show two types of temperature: (a) Average temperatures, obtained by averaging the transformation temperatures for $\alpha \rightarrow \gamma$ and $\gamma \rightarrow \alpha$ transformations. (b) "Extrapolated" temperatures, obtained by plotting the observed temperature for the forward or reverse transformation against the logarithm of the rate of change of temperature during the transformation and extrapolating these curves to the point of intersection, as shown in Figs. 11(a-d).

These extrapolated temperatures form a smooth, continuous curve and approach the equilibrium eutectoid temperature at atmospheric pressure. Therefore, it is believed that the "extrapolated" temperatures more nearly represent the equilibrium eutectoid temperatures than do the average temperatures.

A large amount of data on the pressure dependence of the average temperatures for the eutectoid reaction were obtained, particularly at higher pressures. However, because they appear not to be easily relatable to equilibrium data, the signifi-

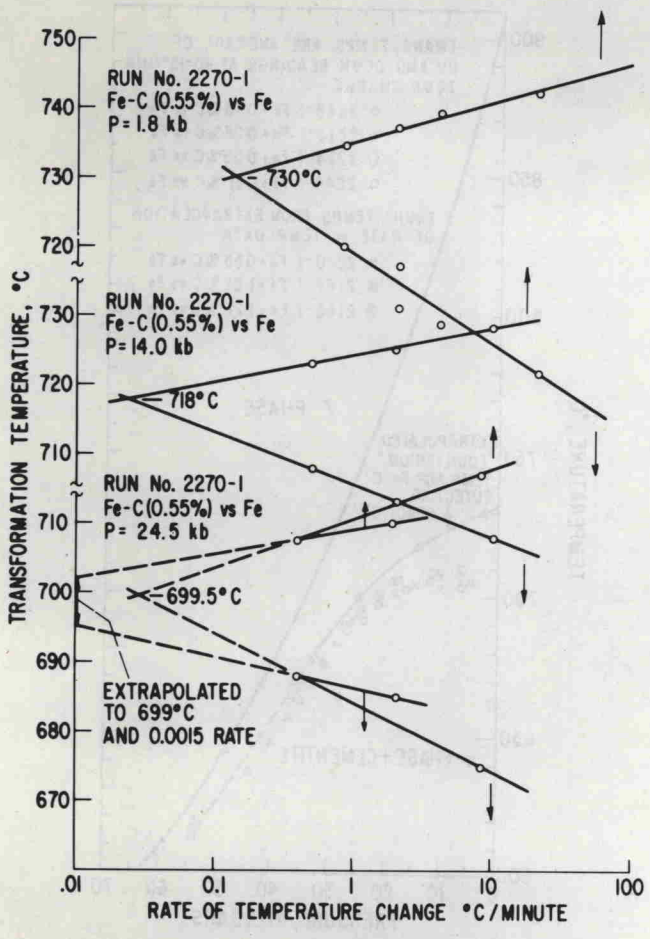

Fig. 11 (a) Kinetic data on Fe-C eutectoid reaction

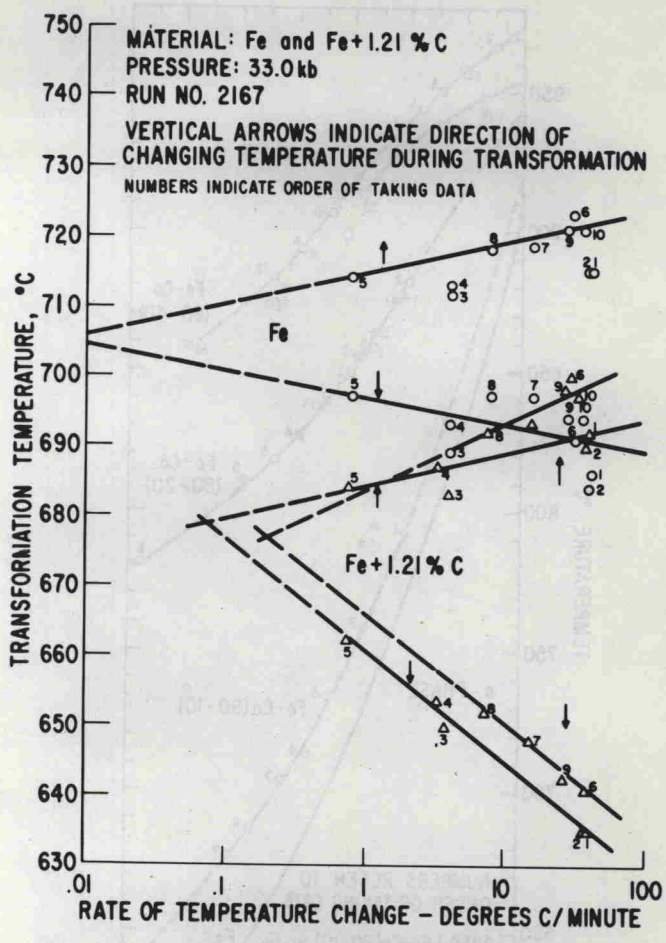

Fig. 11(b) Kinetic data on Fe-C eutectoid reaction

cance must remain questionable until additional kinetic measurements have been made.

(g) The Fe-Mn-C Eutectoid Reaction. The duplex DTCA technique was applied to the measurement of eutectoid transformation temperatures for Fe-Mn-C (98.7-1.0-0.33) versus Fe-Mn (99-1). The application of DTCA to a ternary system proved successful, with very good ΔT-maximum curves resulting. The interpretation of the results for this eutectoid reaction are more complicated than for the Fe-C eutectoid reaction, because the presence of the manganese causes an additional hysteresis in the transformation temperatures. As in the case of the binary alloy Fe-Mn, one should expect for Fe-Mn-C that the manganese would not diffuse to any great extent during the course of the transformation. The equilibrium phase diagram would show a three-phase region, comparable to the two-phase region in the Fe-Mn diagram, where the alpha phase, a carbide phase and an austenite phase co-exist at various manganese concentrations in the state of the eutectoid equilibrium. This three-phase region is reported (10) at 1.0 percent Mn and 0.75 percent carbon to occur at atmospheric pressure between 695 and 720 C.

The observed DTCA transformation temperatures were plotted versus the log rate of temperature change, as shown in Figs. 12(a) and 12(b); the extrapolated temperatures, while having no physical significance beyond locating a point in the three-phase region, are plotted against pressure in Fig. 13. One set of observed transformation temperature data are also plotted against pressure in Fig. 13, showing the actual hysteresis. These data (668 and 730 C) agree fairly well with that reported for 1 atm pressure (10), but with a somewhat larger hysteresis in temperature.

(h) Significance of Breaks in Certain Transformation Curves. The earlier simple DTCA runs as well as some of the later duplex DTCA runs on 1 percent alloys of Ni, Cr and Mn gave forward α-γ transformation P-T curves which exhibited certain reproducible breaks at around 30-40 and 670-715 C. The reverse transformation curves also departed from linearity or regularity and in the opposite direction from that observed for the forward