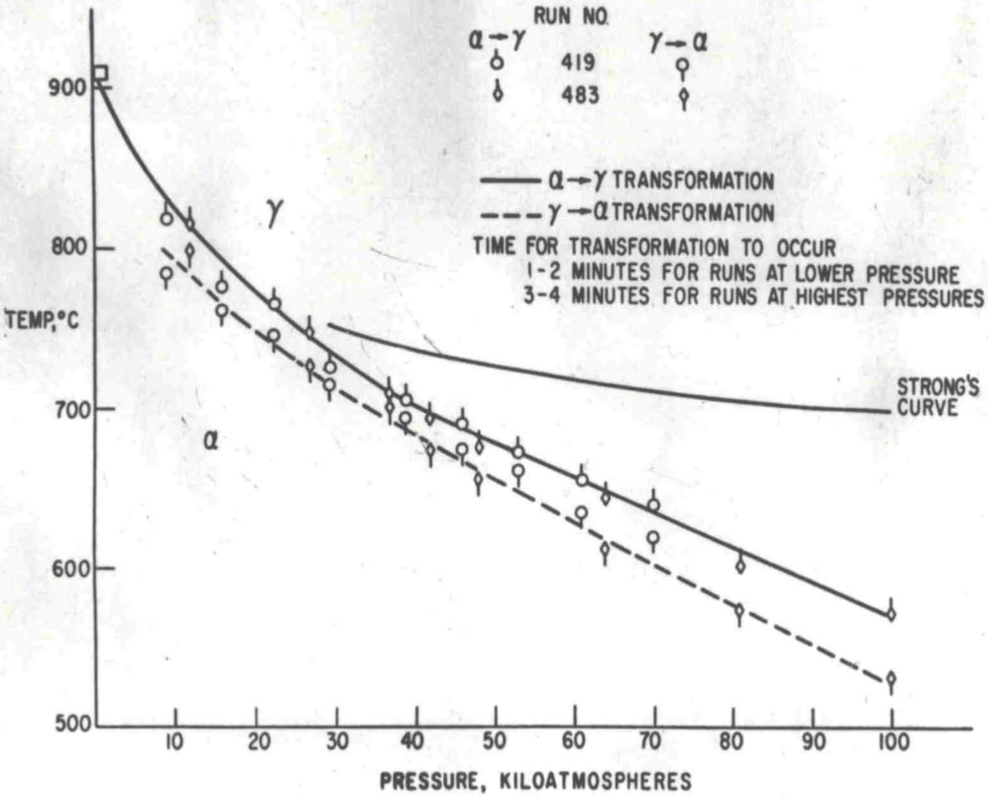

FIG. 4. Effect of pressure on α-γ transformation in iron. Pressure calibration is based on the transitions for Bi and Ba, which were assumed to occur at 24 800 and 77 400 atm, respectively. See footnote reference 2.

production would tend to flow into the core, producing this undesirable heat flux. The even heat produced by the Nichrome heater would seem to produce too much heat at cooler portions of the cell and thus would cause the undesirable shift of ΔT at the transformation.

EXPERIMENTAL RESULTS—THE α-γ TRANSFORMATION OF IRON

The DTCA method was first tested on this transformation, and the results are shown in Fig. 4. The $\alpha \rightarrow \gamma$ transformation was observed with rising temperature, while the $\gamma \rightarrow \alpha$ transformation was observed at lower temperatures and with falling temperature. The temperatures for the forward and reverse transformations differed by as much as 40°C, with a trend toward a minimum of 10–15°C at around 40 000 atm. This subject will be pursued further when better data are available. It is apparent that the DTCA method is applicable to studies of this type, which involve thermodynamic equilibria as well as kinetics of transformation.

The transformation temperature drops regularly with increasing pressure in contrast to that reported earlier by Strong.[3] While this latter work indicated a drop of the transformation temperature to about 700°C at 90 000 atm, the present work indicates that the temperature is around 590°C. The reason for this discrepancy may lie in the failure of Strong's method of detection of phase change, which was by electrical resistivity measurement, to give as sharp an indication of the phase transition as does differential thermal conductivity. Also, Strong's interpretation of the break in the resistivity versus temperature curve as being the start of the change might have caused an error, the break actually corresponding to the end of the transformation which was occurring at the cool ends of the cell.

The transformation temperature is subject to a correction because of temperature gradients which occur along the thermocouple wires while in the pressure field.[4] The platinum 10% rhodium-platinum thermocouple may read 30° low at 600°C and 100 000 atm. Since one might expect this correction to be linear with respect to both temperature and pressure, the entire curve of Fig. 4 would then be shifted upward slightly. At 100 000 atm, the corrected transformation temperature would then be 605°C.

This DTCA method affords an intimate view of temperature gradients within the cell. A typical ΔT curve, as in Fig. 3, would have recorded, at various points along it, the absolute temperature. These temperatures, obtained by means of a potentiometer using one of the two thermocouples, are for the mid-point of one of the metal strip samples. The temperature at the maximum (or inflection) corresponds to the transformation temperature (see arrow, Fig. 3). The initial deflection from linearity s corresponds

[3] H. M. Strong, J. Geophys. Research **64**, 653 (1959).

[4] F. P. Bundy, Sagamore High Pressure Conference, Lake George, New York, June, 1960.