TABLE 1 a-r TRANSFORMATION TEMPERATURES OF IRON AND IRON ALLOYS AT 20, 40 and 60 kb

Pressure		20 kb			40 kb			60 kb		
Temperature change during transformation	direction <u>up-down</u> average <u>rate °C/min.</u>	1	4	av_ -y Tran	format	ion Te	av mperatu	res, °C	+	av
Alloy Fe-X(weight per cent of minor element)										
Fe(pure)	8-12	786	761	773	691	657	674	636	581	609
Fe-A1 (0.54) Fe-A1 (0.75)	8-12 8-12	836 865	79 <b>3</b> 807	814 836	721 733	676 683	699 708	669 67É	618 618	644 648
Fe-Cr (1.09) Fe-Cr (2.95) Fe-Cr (9.49)	8-11 8-12 30-50	770 766 742	750 728 642	760 747 692	687 676 667	640 606 429	663 641 548	631	566 391	598 490
Fe-Mn (1.07) Fe-Mn (2.85)	9-16 9-12	765 576	708 715	736 645	676 638	592 433	634 536			
Fe-Co (10.2) Fe-Co (19.9) Fe-Co (39.6)	30-50 8-12 15-25	810 891 945	781 876 933	796 883 939	726 837 902	694 816 885	710 827 893	683 805 870	630 778 846	656 (a 792 858
Fe-Ni (1.07) Fe-Ni (3.06) Fe-Ni (10.0)	8-12 8-16 22-31	766 736 641	724 662 460	745 698 550	681 655 577	629 564 327	655 610 452	627 520	545 168	585 344(b
		(a (1	a) Exc b) Exc	rapola	ted from	n 52 ki n 53 ki				

a pure iron standard showed a very much smaller change in slope. This apparent discrepancy needs further investigation.

Both of these Fe-Al alloys were utilized as secondary standards in later duplex DTCA runs, where the use of iron would have resulted in the standard transition being too close to that of the second material. Particularly, Fe-Al was used with the 1 percent alloys of Mn, Cr and Ni in iron, and with certain Fe-C runs at the higher pressure.

(b) Iron-Manganese Alloys. The data for two Fe-Mn alloys containing 1.0 and 3.0 percent Mn are shown in Fig.6 and Table 1. The average temperature curves for both alloys appear to be smooth in the region up to 45 kb, except for the scatter from different runs on the 3 percent alloy. However, because of the very large hysteresis in the temperature in these latter data, the average temperature data may not be very accurate; it would seem inadvisable to attribute any significance to apparent changes in slope.

(c) Iron-Chromium Alloys. The data for three Fe-Cr alloys containing 1, 3 and 10 percent Cr are shown in Fig.7 and Table 1. All of the average temperature curves appear smooth, with no significant changes in slope at any point. The 1 percent curve follows closely parallel to the curve for pure iron. The 3 percent curve departs downward at the higher pressures while the 10 percent curve veers upward at these pressures. This behavior may be related to the expansion of the gamma loop at higher pressures; with more data, particularly with a 20 percent alloy, a more complete analysis could be made in this direction.

(d) Iron-Nickel Alloys. The data for three Fe-Ni alloys containing 1, 3 and 10 percent Ni are shown in Fig.8 and in Table 1. All of the average temperature curves appear smooth, with no significant changes in slope at any point. In comparison to the corresponding Fe-Cr alloys, the Fe-Ni alloys transform at lower temperatures and with larger hystereses. Both kinetics and the width of the respective two-phase regions probably make this difference.

(e) Iron-Cobalt Alloys. The data for three Fe-Co alloys containing 10, 20 and 50 percent cobalt are shown in Fig.9 and Table 1. All of these average temperature Fe-Co curves appear smooth with no significant changes in slope. However, the 20 percent data require some additional comment. At 26 kb and at 28 kb, a second transformation was observed at 796 and 788 C, about 70 deg lower than the  $\alpha$ - $\gamma$  transformation. The originand nature of this additional apparent transformation is unknown, and warrants further investigation.

The  $\alpha$ - $\gamma$  transformations in all of the Fe-Co alloys proceeded with the lowest hystereses of any of the materials studied. The reason for the low hysteresis may be surmised by inspection of the Fe-Co phase diagram. A maximum temperature for the transformation is recorded at 45 percent Co, and at this point the vertical (along the temperature axis) distance separating the two phases, alpha and gamma, should be nil, with a congruent





change in phase. The observation of the lowest hysteresis with the 60-40 alloy agrees with this concept.

The extrapolation of the high-pressure  $\alpha - \gamma'$ data usually fits in reasonably well with the atmospheric-pressure data. For the Fe-Co (60-40) alloy, however, where some of the best low-pressure data were obtained, the extrapolation to 972 C was 14 deg lower than that recorded in the literature. A second discrepancy appeared later



