

The maximum value that I can have is the bare exchange value I_b ; thus, the maximum value for the ratio I/I_b is one. Hence, the experimental value of Γ can be used to determine the maximum values of \bar{I} . From Eq. (13) we have

$$\bar{I}_{\max} = 1 + \frac{1}{2} \left[\frac{5}{3} + \frac{\partial \ln I_b}{\partial \ln V} \right] \left[\Gamma + \frac{5}{3} \right]^{-1}, \quad (14)$$

which for $\frac{\partial \ln I_b}{\partial \ln V} \cong 0$ reduces to

$$\bar{I}_{\max} = 1 + \frac{5}{6} \left[\Gamma + \frac{5}{3} \right]^{-1}. \quad (15)$$

Then using values for \bar{I} obtained from Eqs. (14) or (15) we can obtain a minimum value for T_F using Eq. (3).

For weak itinerant FM's $\bar{I} \gtrsim 1.0$ and for weak electron correlation effect $I/I_b \cong 1.0$; thus the second term in Eq. (10) is dominant, and from Eq. (12) we have $\frac{\partial T_c}{\partial P} \sim -1/T_c$. Examples of weak itinerant FM's are the Fe-Ni, Fe-Pt, and Fe-Pd Invar alloys where it has been experimentally observed that $\frac{\partial T_c}{\partial P} \cong -\text{constant}/T_c$.²² For strong itinerant electron FM's $\bar{I} > 1$ and for strong correlation effects $I/I_b < 1$ such that the first term in Eq. (10) is dominant, and from Eq. (12) we have $\frac{\partial T_c}{\partial P} \sim T_c$. An example of a strong itinerant FM is Ni, where it is found that $\frac{\partial T_c}{\partial P} = (5/3) \kappa T_c \cong 0.68^\circ\text{K/kbar}$ in good agreement with experimental values of $0.32\text{-}0.42^\circ\text{K/kbar}$.⁹ It is noteworthy that in the limit of weak itinerant FM and for large Γ such that $|\Gamma| \gg 5/3$ and neglecting the volume dependence of I_b , the results of this paper reduce to the results given previously by Wohlfarth and Bartel.¹²

III. EXPERIMENTAL RESULTS

For the preparation of the solid solutions, powders of 99.9% pure Mn, As, and Sb were mixed to the desired proportions, pressed into pellets, sealed in an evacuated quartz tube, and heated to 1073°K for 2 days. The chemically reacted product was then crushed, made into pellets, and annealed at 1073°K for 1 day. There were no observed differences in the magnetic transitions or chemical composition if the samples were quenched in air or were slowly furnace cooled. Chemical analysis of these materials indicated they were stoichiometric to within 4 at.% and the ratio of As to Sb was within 1 at.% of the nominal value. Powder x-ray diffraction patterns indicated the presence of MnO in some of the solid solutions. The presence of MnO should not affect the magnetic transition temperatures of these materials.

The self-inductance technique^{23,24} was used to determine the FM to PM transition as a function of pressure and temperature. Hydrostatic pressure was applied with a 4.5-kbar helium gas system²⁵ on the solid solutions which had transition temperatures less than 323°K and with a Harwood 30 kbar liquid pentane apparatus on the solid solutions which had transition temperatures greater than 323°K. A typical reduced self-inductance versus temperature plot as obtained for the $\text{MnAs}_{0.9}\text{Sb}_{0.1}$ solid solution is shown in Fig. 2. The transition temperature was arbitrarily taken as the half-transition point.

The experimental results are summarized in Figs. 3-5. In Fig. 3 the FM to PM transition temperature, T_c , is plotted as a function of concentration. The double curve in the concentration range $0.9 \leq x \leq 1.0$ is due to the thermal hysteresis associated with the first-order hexagonal FM to orthorhombic PM transition. No hysteresis is observed for the solid solutions in the concentration range $0 \leq x < 0.90$ which is indicative of a second-order FM to PM transition.