1% with a magnetic balance. Electrical resistance was measured by a standard four-probe method in the range from 77 K to 700 K with current reversal. The current leads and potential probes were spot-welded on the specimens with manganin wires of 0.2 mm in diameter.

§3. Results

Figure 1 shows, as an example, the magnetization curves along the direction parallel and perpendiculer to the c axis at 4.2 K for Fe_2P and $(Fe_{0.8}Ni_{0.2})_2P$ compounds. The easy direction of magnetization was the c axis and no magnetocrystalline anisotropy in the basal plane was observed for all the compounds. The spontaneous magnetization σ_s was determined by extrapolating the linear part of the c axis magnetization back to zero field. The temperature denendence of σ_s is shown in Fig. 2 for $(Fe_{1-x}Ni_x)_2P$ compounds. The transition from ferromagnetic to paramagnetic at T_c for all the compounds shows a second order transition except for Fe_2P, where the transition at T_c is of the first order accompanying by the deformation of the lattice.

Figure 3 shows the inverse susceptibility χ_g^{-1} vs temperature curves for the compounds. Here, no correction for the temperature independent susceptibility was made except for the compound with $x=0.7$, for which the χ_g in Fig. 3 is the estimated value by sustraction of the χ_g for Ni_2P from the measured one. The χ_g for the compounds in the range of $0 \leqq x \leqq 0.7$ well obeys the Curie-Weiss law

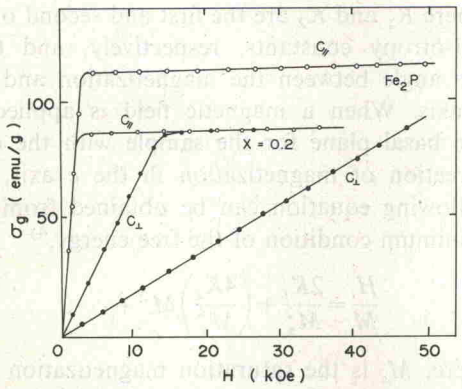

Fig. 1. Magnetization curves along the direction parallel and perpendicular to the c axis at 4.2 K for $x=0$ and $x=0.2$ in $(Fe_{1-x}Ni_x)_2P$.

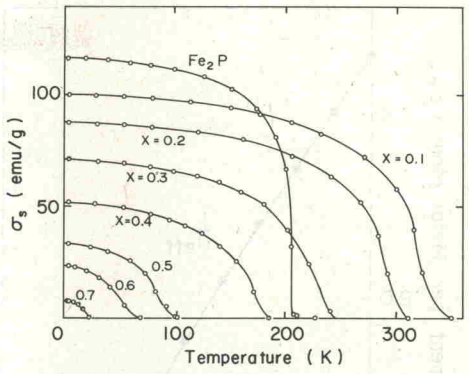

Fig. 2. Spontaneous magnetization per gram σ_s plotted against temperature for $(Fe_{1-x}Ni_x)_2P$.

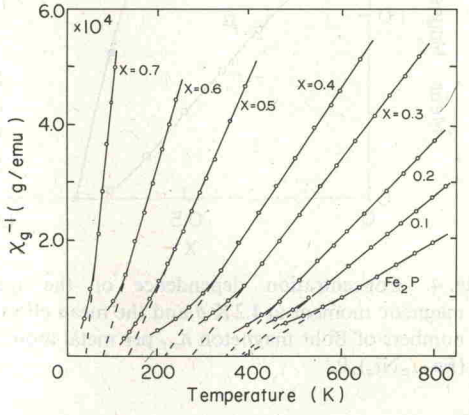

Fig. 3. Inverse susceptibility per gram χ_g^{-1} plotted against temperature for $(Fe_{1-x}Ni_x)_2P$.

except in the vicinity of T_c. The compounds with $x \geqq 0.8$ show the Pauli paramagnetism and the value of χ_g was 3.2×10^{-6} (emu/g) independent of x.

Figure 4 shows the concentration dependence of the magnetic moment $\bar{\mu}$ at 4.2 K and the effective numbers of Bohr magneton $\bar{n}_{eff}$ per metal atom. Both $\bar{\mu}$ and $\bar{n}_{eff}$ decrease monotonically with increasing x and become zero at about $x=0.7$. The ferromagnetic Curie temperature T_c and the paramagnetic Curie temperature θ_P are plotted against the concentration of Ni in Fig. 5. The value of θ_P decreases monotonically with increasing x. On the other hand, the curve of T_c takes a maximum at about $x=0.1$ in agreement with the result reported by Fruchart *et al.*[3]

Figure 6 shows the temperature dependence of the electrical resistivity along the c axis for $(Fe_{1-x}Ni_x)_2P$ compounds. In the figure, the data of Ni_2P are those obtained by employ-

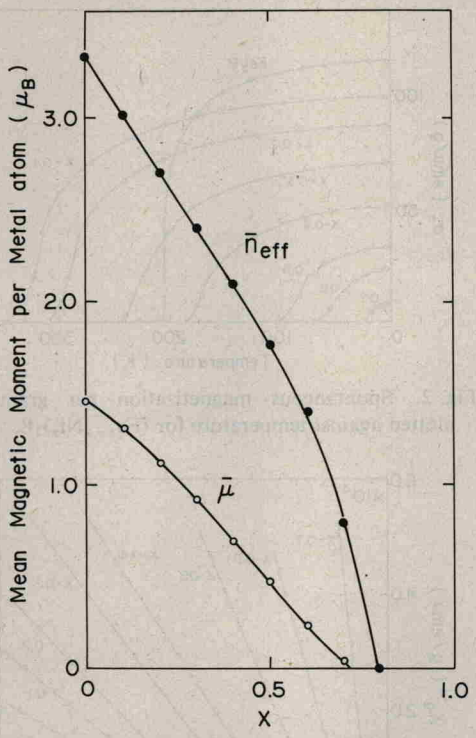

Fig. 4. Concentration dependence of the mean magnetic moment at 4.2 K $\bar{\mu}$ and the mean effective numbers of Bohr magneton $\bar{n}_{eff}$ per metal atom for $(Fe_{1-x}Ni_x)_2P$.

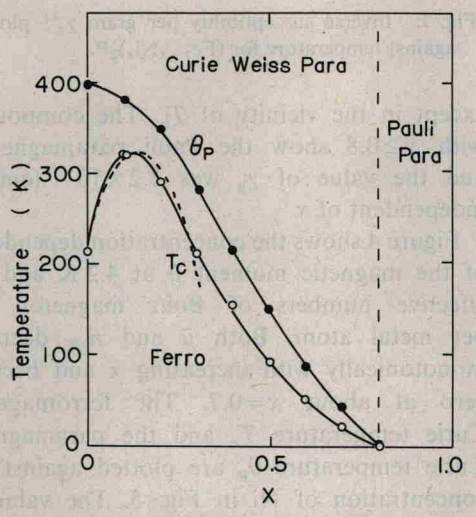

Fig. 5. The ferromagnetic and paramagnetic Curie temperatures, T_c and θ_P, respectively, plotted against composition for $(Fe_{1-x}Ni_x)_2P$.

ing the polycrystal specimen since no single crystal was available. The resistivities of Fe rich compounds increase with increasing temperature at low temperatures which might be

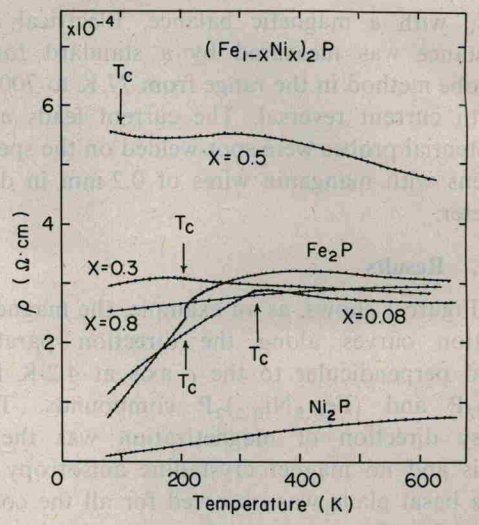

Fig. 6. Temperature dependence of the electrical resistivity along the c axis for $(Fe_{1-x}Ni_x)_2P$.

associated with spin disorder, but decrease with increasing temperature at higher temperatures in paramagnetic state. On the other hand, the resistivities of the compounds with $x \geqq 0.8$ increase with increasing temperature at all temperature ranges. These results might be attributable to the hole in the narrow d electron band. It may be noted that the jump of the resistivity due to the first order transition observed in Fe_2P disappears already by substituting only 8% of Fe by Ni.

§4. Discussion

For the hexagonal crystal in ferromagnetic state, the magnetocrystalline anisotropy is conventionally expressed by

$$E = K_1 \sin^2\theta + K_2 \sin^4\theta + \cdots, \qquad (1)$$

where K_1 and K_2 are the first and second order anisotropy constants, respectively, and θ is the angle between the magnetization and the c axis. When a magnetic field is applied in the basal plane for the sample with the easy direction of magnetization in the c axis, the following equation can be obtained from the minimum condition of the free energy,[4]

$$\frac{H}{M} = \frac{2K_1}{M_s^2} + \left(\frac{4K_2}{M_s^4}\right) M^2 + \cdots. \qquad (2)$$

Here, M_s is the saturation magnetization and M is the magnetization along the direction perpendicular to the c axis at the effective field H. Since M is proportional to H as