# On the Magnetization Process in an Iron-Phosphorus-Carbon Amorphous Ferromagnet

$Ni_{10}P_{13}C_7$ shows fairly broad peak and the peak almost smears out for $Fe_{70}Cr_{10}P_{13}C_7$.

**Observation of the Magnetostriction in Ferromagnetic Amorphous Thin Ribbons**

N. TSUYA, K.I. ARAI, Y. SHIRAGA and T. MASUMOTO

Physics Letters, **51A** (1975), 121.

The first observation of the magnetostriction of the amorphous thin ribbons was made at room temperature, and it was found that in $Fe_{0.8}P_{0.13}C_{0.07}$, the saturation magnetostriction $\lambda$ in the plane was $18.5 \times 10^{-6}$ which was several times bigger than that of bulk iron in the polycrystalline state.

**Spin Wave Excitation in Amorphous Fe-P-C Alloys**

Noriaki KAZAMA, Tsuyoshi MASUMOTO and Hiroshi WATANABE

J. Phys. Soc. Japan, **37** (1974), 1171.

The temperature dependence of the magnetization at low temperatures has been examined in order to obatin the information about the magnetic excitation in amorphous Fe-P-C ferromagnets. The result reveals clearly the $T^{3/2}$ temperature dependence for the magnetization change, which is characteristic of low energy spin wave excitation with quadratic dispersion $\hbar\omega_q = D \cdot q^2$ for the wave vector $q$. The value of $D$ for $Fe_{80}P_{13}C_7$ amorphous alloy is calculated to be 98 meV·Å². The diminuation of the dispersion coefficient shows the increase of spin wave excitation in the amorphous state.

**Study of a Magnetic Phase Transition in Amorphous Ferromagnets with Polarized Neutrons**

Noriaki KAZAMA and Hiroshi WATANABE

J. Phys. Soc. Japan, **39** (1975), 1411.

Magnetic phase transition of amorphous ferromagnets Fe-P-C and Co(Fe)-Si-B has been investigated by means of a neutron depolarization method. The Curie temperature at H=0 is determined with accuracy for the amorphous Fe-P-C alloy which includes only one magnetic atom. It turns out that the measured data for Fe-P-C alloy obey the power laws (i) $B_s{}^2\delta \cong |(T_c - T)/T_c|^{2\beta}$ with $\beta = 0.36 \pm 0.02$ below $T_c$, (ii) $B_s{}^2\delta \cong |(T - T_c)/T_c|^{\nu}$ with $\nu = 0.55 \pm 0.05$ above $T_c$, if simplified assumptions are used about ferromagnetic domain structures.

**On the Magnetization Process in an Iron-Phosphorus-Carbon Amorphous Ferromagnet**

Hiroyasu FUJIMORI, Tsuyoshi MASUMOTO, Yoshihisa OBI and Michio KIKUCHI

Japan. J. Appl. Phys., **13** (1974), 1889.

The B-H hysteresis loop and the magnetic domain structure have been examined for an amorphous $Fe_{80}P_{13}C_7$ ribbon alloy produced by the centrifugal solidification technique. The as-quenched alloy exhibits soft-ferromagnetic properties which are characterized by a rectangular type loop with the large Barkhausen jumps and low coercive force of about 0.12 Oe. Magnetic domain structure consists of the 180°-domain and the maze-domain. By annealing for 350 mins at 300°C, the coercive force decreases to 0.06 Oe. An additional annealing increases again the coercive force by transformation of the amorphous to the b.c.c. crystalline phase.

### New Amorphous Ferromagnets with Low Coercive Force

Michio KIKUCHI, Hiroyasu FUJIMORI, Yoshihisa OBI and Tsuyoshi MASUMOTO
Japan. J. Appl. Phys., **14** (1975), 1077.

Soft-ferromagnetic properties have been studied for two amorphous alloy systems of $(Fe_{1-x}Co_x)_{80}P_{13}C_7$ and $(Fe_{1-x}Co_x)_{75}Si_{15}B_{10}$ by means of the X-ray diffraction, thermo-electrical resistance, thermo-magnetization and B-H loop. The B-H loops measured using straight samples were highly rectangular for the as-quenched state. The ratio of the remanence to the saturation magnetization are small ($0.4\sim0.6$) for all the alloys. The alloy of $Fe_5Co_{70}Si_{15}B_{10}$ has a very small value of coercive force, 0.01 Oe, and the high value of the maximum permeability, 120,000. The magnetic field annealing has been found to be very effective in improving the low-field magnetic properties. These excellent soft-magnetic properties may be attributed to the zero-magnetostriction and the isotropic nature of the amorphous structure.

### Structural Stability and Mechanical Properties of Amorphous Metals

T. MASUMOTO and R. MADDIN
Mater. Sci. Eng., **19** (1975), 1.

This is a review of the new information concerned with the structural stability and mechanical properties obtained, for the most part, by research groups at the Tohoku University. The contents consist of eight subjects; 1) atomic structure, 2) effect of temperature on structure, 3) effect of deformation on structure, 4) elastic and anelastic behavior, 5) static strength, 6) deformation, 7) fracture, 8) ductility and toughness, and 9) fatigue properties. From these discussions, it will be concluded that amorphous metals represent a most intriguing group of materials and with further work a new family of materials become available for commercial applications.

### Fracture Toughness of Amorphous Metals

Hiroshi KIMURA and Tsuyoshi MASUMOTO
Scripta Met., **9** (1975), 211.

The fracture toughness of some amorphous metals has been measured as functions of the temperature and strain rate by using a tear test of a trouser-leg type. The tearing energy measured by this method and the fracture toughness estimated by Irwin's relation were compared with those of various other materials. These values for amorphous metals are comparable with those for strong steels, and are very high