# Giant ΔE Effect and Magnetomechanical Coupling Factor in Amorphous Fe80P13C7 Ribbons

# Abstracts of Papers on Amorphous Materials Published in Other Journals

## Effects of Alloying Elements on Strength and Thermal Stability of Amorphous Iron-Base Alloys

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Proc. of 2nd Intern. Conf. of Rapidly Quenched Metals, 1975, Section I (*Rapidly Quenched Metals*, ed. by N.J. Grant and B.C. Giessen), MIT Press, (1976), 273.

The effects of alloying elements on hardness and crystallization temperature have been studied for amorphous alloys with the compositions $Fe_{80-x}M_xP_{13}C_7$, where M=Ti, V, Cr, Mn, Co, Ni and Cu. As a result, it has been found that the average outer electron concentration has a significant effect on the hardness and crystallization temperature. This suggests that the alloying elements are mainly confined to the bonding character of the outer electrons of the component elements.

## Saturation Magnetostriction and Volume Magnetostriction of Amorphous Ribbons Based on Fe-Ni and Fe-Co

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Proc. of 2nd Intern. Conf. on Rapidly Quenched Metals, 1975, Section I (*Rapidly Quenched Metals*, ed. by N.J. Grant and B.C. Giessen), MIT Press (1976), 489.

The saturation magnetostriction and the forced volume magnetostriction of Fe-Ni and Fe-Co amorphous ribbons were measured from 77°K to room temperature by a three terminal capacitance method. It was found that the magnetostriction was nearly isotropic. In Fe-Ni amorphous system, the saturation $\lambda_s$ and the volume magnetostriction constants $\delta\omega/\delta H$ decreased monotonously with the increase of Ni concentration from $31\times10^{-6}$ and $21\times10^{-10}$/Oe respectively for $Fe_{0.80}P_{0.13}C_{0.07}$ to $15\times10^{-6}$ and $7\times10^{-10}$/Oe respectively for $Fe_{0.40}Ni_{0.40}P_{0.13}C_{0.07}$. The temperature dependence of the saturation magnetostriction was not simple decreasing function of the temperature. In Fe-Co system, there was a remarkable change of the sign of the magnetostriction nearly equal to $Fe_{0.047}Co_{0.703}Si_{0.15}B_{0.10}$.

## Giant ΔE Effect and Magnetomechanical Coupling Factor in Amorphous $Fe_{80}P_{13}C_7$ Ribbons

K.I. ARAI, N. TSUYA, M. YAMADA and T. MASUMOTO

IEEE Transactions on Magnetics, MAG-**12** (1976), 936.

The magnetomechanical coupling factor $k$, the Young's modulus $E$ and the $\Delta E$ effect as a function of bias field were measured by a mechanical resonance method of amorphous $Fe_{80}P_{13}C_7$ ribbons which were annealed at different temperatures in a magnetic field. In the ribbon which was annealed at 350°C for 20

minutes, a remarkably large coupling factor $k$ was found in the bias field 5 Oe to be 0.53, which was almost the same as the value of the high magnetostrictive rare earth-$Fe_2$. The $\Delta E$ effect increased with the increase of the bias field, took a gigantic value 0.8 at about 5 Oe and then decreased monotonically with the increase of the bias field. The $\Delta E$ effect is known to correspond to a change in sound velocity, so that the change of the sound velocity was also observed as a function of the frequency from 100 kHz to 1MHz in a delay line using the ribbons.

**Zero Magnetostriction and Extremely Low Residual Magnetic Loss in Fe-Co Amorphous Ribbons**

K.I. ARAI, N. TSUYA, M. YAMADA and T. MASUMOTO

IEEE Transactions on Magnetics, MAG–**12** (1976), 939.

The initial permeability $\mu_i$, the loss factor tan $\delta$, and the inverse quality factor tan $\delta/\mu_i$ of $Fe_5Co_{70}Si_{15}B_{10}$ ribbons 35 $\mu$m, 30 $\mu$m, 25 $\mu$m and 21 $\mu$m in thickness were measured with a Maxwell Bridge from room temperature to 140°C in the high-frequency region from 3 kHz to 500 kHz. The initial permeability of the ribbon 21 $\mu$m in thickness was about 10,600 at 3 kHz and 4300 at 500 kHz. The residual loss coefficient $C_1$ and the hysteresis loss coefficient $h_1$ were extremely low, about $8\times10^{-3}$ and 60 (cm/A), respectively. In the high-frequency region, the eddy current loss term increases with the square of the thickness of the ribbons and plays the most important part of all the magnetic losses.

**Deformation of Amorphous Metals**

Tsuyoshi MASUMOTO and Takeo MURATA

Mater. Sci. Eng., **25** (1976), 71.

Some problems to be clarified in the research field concerned with the deformation of amorphous metals have been discussed under experimental evidences obtained so far. The contents consist of 1) elastic and anelastic deformation, 2) temperature and strain rate effects on plastic deformation (mode of deformation, inhomogeneous deformation and homogeneous deformation), and other important effects on plastic deformation (structural effect, compositional effect, environmental effects).

**Anelastic Strain Recovery of Amorphous Metals**

Takeo MURATA, Hisamichi KIMURA and Tsuyoshi MASUMOTO

Scripta Met., **10** (1976), 705.

Amorphous $Pd_{80}Si_{20}$, $Fe_{80}P_{13}C_7$ and $Cu_{60}Zr_{40}$ alloys have been prepared by a rapid cooling of melts using the centrifugal and roller type quenching apparatuses. The creep strain and the strain of the anelastic recovery have been measured as functions of the temperature and applied stress. Creep deformation can be approximated by the model which consists of the Maxwell and Voigt elements connected in series, and is considered to be of visco-elastic origin.