Fracture Toughness of Amorphous Metals

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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

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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 ($0.4 \sim 0.6$) 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 compared with inorganic glasses and polymers. By using the values of tearing energy, the ideal yield stress for various amorphous metals was estimated to be about two times the nominal yield stress, possibly because stress concentration at defects preexisted in the specimens.

Fatigue Fracture of Amorphous Pd-20at.%Si Alloy
T. OGURA, T. MASUMOTO and K. FUKUSHIMA
Scripta Met., **9** (1975), 109.

To obtain a general information about fatigue properties of amorphous metals, the S-N characteristics and fracture process have been examined by using the amorphous Pd-Si alloy. The amorphous metal suffers fatigue fracture and exhibits the S-N curve having a distinct fatigue limit. The macro- and micro-scopic features of fracture surface and the behavior of fatigue crack growth are similar for common ductile materials.

Propagation of Fatigue Cracks in Amorphous Metals
T. OGURA, K. FUKUSHIMA and T. MASUMOTO
Scripta Met., **9** (1975), 979.

The properties of propagation of fatigue cracks in amorphous Pd-Si alloy have been examined with a view to clarifying the mechanism of dynamic fracture in amorphous materials. It was observed that both the plastic deformation near a fatigue crack and propagation of the crack are controlled by the stress intensity factor near the tip of the crack, and that the propagation of a crack in the amorphous metal strictly obeys the law which is theoretically derived. This may be due to the fact that amorphous metals are structurally simple and homogeneous, and moreover is a nearly ideal elastic and perfectly plastic solid.

Corroison Resistivity of Amorphous Iron Alloys Containing Chromium
Masaaki NAKA, Koji HASHIMOTO and Tsuyoshi MASUMOTO
J. Japan Inst. Metals, **38** (1975), 835.

In order to evaluate the corrosion resistivity of amorphous iron alloys which have been characterized by outstanding mechanical properties, immersion tests and electrochemical measurements of the amorphous alloys were carried out in acidic and neutral solutions. In a 1 N NaCl solution at 30°C, 0.01–1 N HCl solutions at 30°C and in 10% $FeCl_3 \cdot 6H_2O$ solutions at 40 and 60°C, pitting corrosion did not occur on the amorphous Fe-Cr-P-C and Fe-Cr-Ni-P-C alloys and the weight change of the alloys containing 8 at% or more Cr was not detected by a microbalance after immersing for 168 hr. The critical potential for pitting did not appear on polarization curves of the amorphous alloys and the anodic current higher than 10^{-7}A/cm^2 was not observed over the potential range 0 to 0.5 V (SCE) in 1 N NaCl and 0 to 0.9 V (SCE) in 1 M H_2SO_4 by the potentiostatic anodic polarization of the alloys containing 8 at% or more Cr. The extremely high corrosion resistivity of