ESCA Study of the Passive Film on an Extremely Corrosion-Resistant Amorphous Iron Alloy

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Chemical Vapour-Deposited Silicon Nitride. Part 1. Preparation and Some Properties

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J. Mater. Sci., **11** (1976), 593.

Pyrolytic Si_3N_4 has been deposited on a graphite substrate, using a mixture of $SiCl_4$, NH_3 and H_2. The pyrolysis is performed with deposition temperatures of 1100 to 1500°C, total gas pressures of 5 to 300 Torr, and flow rates of H_2=700, NH_3=60 and $SiCl_4$ (liq.)=0.8 $cm^3\ min^{-1}$. Massive amorphous and crystalline pyrolytic forms of Si_3N_4 are prepared at a maximum thickness of 4.6 mm. The effects of deposition conditions on some properties of the deposited products and the dependence of formation of amorphous or crystalline deposits on deposition temperature and total pressure were investigated. The surface and cross-sectional structures show growth cones and oriented crystals which are strongly dependent on the deposition conditions. The thin deposits are translucent; the thick deposits vary in colour from white to black. The silicon content is close to the theoretical composition and independent of the deposition conditions, while the oxygen content increases with decreasing deposition temperature and total pressure. No segregation of silicon and nitrogen at cone boundaries was found.

Chemical Vapour-Deposited Silicon Nitride. Part 2. Density and Formation Mechanism

Koichi NIIHARA and Toshio HIRAI

J. Mater. Sci., **11** (1976), 604.

Chemical vapour-deposited Si_3N_4 (pyrolytic Si_3N_4) has been prepared from a $SiCl_4+NH_3/H_2$ system at 1100 to 1500°C under total pressures of 5 to 300 Torr. The densities of crystalline deposits are 3.15 to 3.18 g cm^{-3}, nearly independent of the deposition conditions. On the other hand, the densities of amorphous deposits depend strongly on the deposition conditions and have a minimum value of 2.60 g cm^{-3} at 1200°C and 40 Torr. The deposition rate of Py–Si_3N_4 obeys a linear law. The rate of increase in thickness is markedly affected by the deposition conditions, its maximum value being 0.73 mm h^{-1} for crystalline deposits at 1400°C and 40 Torr, and 0.36 mm h^{-1} for the amorphous deposits at 1300°C and 40 Torr. The activation energies of formation of Py–Si_3N_4 are 30 to 33 and 53 kcal mol^{-1} for the amorphous and crystalline deposits, respectively. The formation mechanism is also discussed.

ESCA Study of the Passive Film on an Extremely Corrosion-Resistant Amorphous Iron Alloy

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Corrosion Science, **16** (1976), 909.

X-ray photoelectron spectroscopy was applied to study the composition of the passive film formed on an extremely corrosion resistant amorphous Fe-10at.%Cr–

13at.%P–7at.%C alloy in 1 N HCl. The passive film consists mainly of hydrated chromium oxyhydroxide which is a common major constituent of passive films on crystalline stainless steels. The extremely high corrosion resistance of the amorphous alloy can only in part be attributed to the formation of a protective hydrated chromium oxyhydroxide film.

Stress Corrosion Cracking of Amorphous Iron Base Alloys

Asahi KAWASHIMA, Koji HASHIMOTO and Tsuyoshi MASUMOTO

Corrosion Science, **16** (1976), 935.

The stress corrosion cracking behaviour at room temperature of amorphous Fe-Cr-Ni-P-C alloys subjected to constant strain rates was studied in some acidic solutions containing Cl^- ions. Hydrogen embrittlement of the alloys occurred in the potential region lower than –300 mV relative to the corrosion potential in acidic solutions regardless of Cl^- concentration. In the passive potential region no embrittlement was observed during tests in neutral NaCl solutions and in acidic solutions with low concentrations of Cl^- ions. Only when tensile stress was applied to the specimen in relatively strong acidic solutions containing a certain amount of Cl^- ions, fracture stress decreased in this potential region. The lowering of the fracture stress can also be attributed to hydrogen embrittlement.

Magnetic Domain Structure of an Amorphous Fe-P-C Alloy

Yoshihisa OBI, Hiroyasu FUJIMORI and Hideo SAITO

Japan. J. Appl. Phys., **15** (1976), 611.

The domain structure of an amorphous $Fe_{80}P_{13}C_7$ alloy ribbon produced by the centrifugal solidification technique was investigated using the magnetic powder pattern technique. Two different types of domains (a maze domain and a 180°-domain) were observed on the specimen surface. The relationship between the domain structure and the magnetization process was also investigated. The results showed that some of the 180°-walls, which ran nearly parallel to the long axis of the ribbon, caused the hysteresis in the magnetization curve, while the maze domain was responsible for the difficulty in obtaining the saturation in magnetization. The maze domain arises probably from the uniaxial magnetic anisotropy having the direction of easy magnetization perpendicular to the surface. This anisotropy seems to be caused by the magnetoelastic coupling between positive magnetostriction and internal stress in the specimen.

Magnetic Properties of an Fe-13P-7C Amorphous Ferromagnet — The Effects of Stress, Stress-Annealing and Magnetic-Field Annealing —

Hiroyasu FUJIMORI and Tsuyoshi MASUMOTO

Trans. Japan Inst. Metals, **17** (1976), 175.

Measurements have been made of the magnetization and its hysteresis loop of an Fe-13P-7C amorphous alloy in the form of ribbons. The as-quenched specimen