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

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

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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

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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–