Pollutants in the Museum Environment

PRACTICAL STRATEGIES FOR PROBLEM SOLVING IN DESIGN, EXHIBITION AND STORAGE

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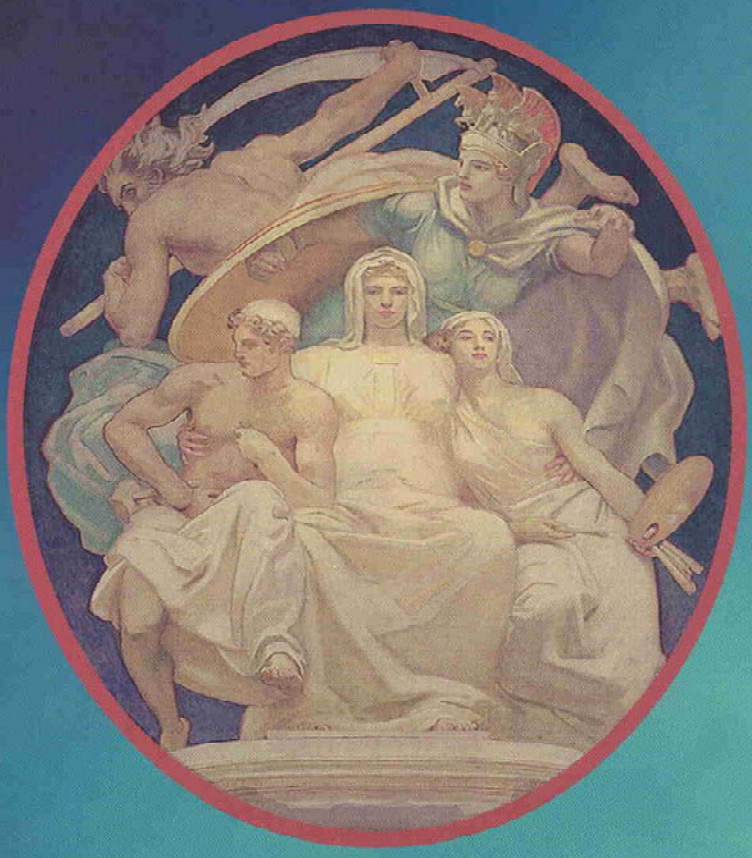

Static and Corrosion Intercept™ products.

Static and Corrosion Intercept™ (products of Engineered Materials, Inc.), called reactive polymers, consist offinely divided, highly reactive copper in a polymer matrix. The polymer matrix is often polyethylene, and these materials are available as sheets, corrugated plastic, as bags or bubblewrap. They were developed for the protection of sensitive materials from electrostatic discharge and corrosion and are intended to be used as enclosures to protect materials from corrosive environments containing poIlutants such as hydrogen sulfide, carbonyl sulfide, chlorine and hydrogen chloride. The copper particles function as semi-conductors (crystalline solids, which conduct electricity), otherwise known as Faraday Cages, which operate on the principle that an object encased by a continuous conductive layer will not be affected by electrical charges applied to the outside of the conductive layer. The cage provides active sacrificial sites with which pollutants will react before reaching the object inside (Engineered Materials, Inc. 1993: 4). In normal corrosive atmospheres, Corrosion Intercept™ is reported to protect non-ferrous metals enclosed in the product für at least 10 years per mil (0.001in or 0.0254mm) of Intercept™ (Engineered Materials, Inc. 1995a). The surface of Static Intercept™ is oxidized, making it slightly hygroscopic, enhancing its ability to react with pollutants. Finely divided copper particles deposited in the polymer matrix create a tortuous path für corrosive gases, making it impossible für pollutants to travel through the plastic without reacting with the copper, whose surface area is extremely high. The protection rate is projected at about 10 years per mil (0,001in or 0.0254mm) of Intercept™, based on an average sulfur level of 7000 ppb (9265.17 µg/m³) (Engineered Materials, Inc. 1995b). Intercept™ products are said to react with ozone and alkaline materials as weIl as acidic vapors. They have been identiried as passive bactericides because of the presence of copper, although it is unlikely that they would act to kill bacteria and maid not in intimate contact. No volatile chemicals are used in the manufacture of Intercept™, and they conform with NASA outgassing and non-volatile residue specifications, as weIl as Raytheon outgassing specifications (Engineered Materials, Inc. 1995b).

The issue of whether preferential corrosion can occur in metal objects lower in the electromotive scale than copper has been discussed with the manufacturer. This phenomenon has not been observed with Intercept™ products in use in museums and is unlikely to occur under ambient conditions. It is, nevertheless, theoretically possible under extremely adverse environments where an electrolyte such as salt water might be present in same quantity. Where dissimilar metals are joined together, it is said to afford protection against galvanic coupling corrosion (Engineered Materials, Inc. 1994: 3). Static Intercept™ products afford better protection against galvanic corrosion because they are somewhat more reactive than Corrosion Intercept™ products. The film is 7 to 10 times more reactive than copper metal because of the particle size and type of copper used. Silver is about 21 times slower to corrode than Intercept™ products (according to the manufacturer). The product has been used effectively to cover green wood palettes, thus preventing corrosion from sulfur, formaldehyde, acetic acid and forrnic acid corrosion of sensitive computer components at a major computer manufacturer (Engineered Materials, Inc. 1995b: 4). Intercept™ products are reported to provide a bettel barrier to sulfur and chlorille than Aclar®, a clear high vapor barrier film (PCTFE with polyethylene and PET (Mylar®) surfaces). It is less effective, however, than Aclar® as a barrier to oxygen. Foil laminates are better moisture barriers than Intercept™ products, but are said to be less effective barriers to gases.Nevertheless, water vapor permeability for Intercept™ products is less than half of that of the equivalent thickness of polyethylene (Donaldson 1997).

Penetration times were compared für LDPE films and the equivalent thickness Corrosion Intercept™ LDPE, which was exposed to similar amounts of hydrogen sulfide.

The results indicated that hydrogen sulfide penetrates LDPE 1000 times sooner than the equivalent Corrosion Intercept™ product (Franey and Donaldson 1992: 1067-8).

E.I. DuPont exposed Corrosion Intercept™ polyethylene films to chlorine gas to determine penetration time and found that at levels of 1000 ppb (2927.35 µg/m³) Cl_2, it took 7.4 days to penetrate, whereas it took the equivalent of 35 years to penetrate, providing approximately 1700 times more protection than normal polyethylene.

In other words, a 1 mil (0,001in or 0.0254cm) thick film of Corrosion Intercept™ provided the same protection against chlorine as a 1.7in (0.043m) thick film of normal polyethylene.

These tests indicated that at ambient levels simulated at 0.01 ppm, it would take more than 1000 years für chlorine gas to penetrate Intercept™ (Gold and Robson 1990).