

## **Corrosion of High Voltage Ion Pump Connections** aka "Green Crud"

Occasionally, in operating Varian-style ion pumps, a form of corrosion appears on the high voltage feedthrough. This corrosion is greenish in color and can become serious enough to cause electrical leakage, arcing and fusing of the connector to the feedthrough (which in turn can cause damage to the feedthrough when the connector is forcibly removed.) One user's analysis of the material shows metal oxides and chlorides with copper, nickel and aluminum the dominant metals.

**First:** The problem has been observed before, but its occurrence is quite infrequent. In the thousands of installations which we have, reports of this problem are in the single digits.

**Second:** When it does occur, it seems to be related to circumstances surrounding the environment in which the pump operates. Specifically, high humidity and condensing atmospheres tend to be involved. In some cases, presence of corrosive materials, even trace amounts, in conjunction with condensing atmospheres, has been involved. In advanced cases, the corrosion also invades the high voltage connector, and in some cases actually corrodes the feedthrough to the point of producing a vacuum leak. There has been some evidence that the problem occurs more often when the axis of the feedthrough is mounted in the vertical position. However, there are not sufficient cases under any specific circumstances to verify the cause.

**Third:** The high voltage feedthrough brazing process does not involve any chemical flux; it is an all-metallic vacuum braze. The banana plug in the connector is nickel plated brass. If conditions are clean and dry, there should be no interactions among the materials. Handling of the ceramic insulator portion of the high voltage feedthrough can leave conducting contaminants on the surface.

**Repair:** In mild cases, the corrosion can be removed with DI water and lint-free wipes, followed by an alcohol rinse. In more advanced cases, it is recommended that both the high voltage feedthrough and high voltage connector be replaced. Contact Duniway Stockroom Corp. for information on replacement parts and repair services.

**Prevention:** A solution for this problem and similar problems that are encountered in other high voltage applications, is to coat the high voltage feedthrough with materials that exclude moisture condensation on the ceramic surfaces. Two materials are available for this application: Pentavac 5™ (polyphenyl ether) or silicone grease, such as Dow Corning High Vacuum Grease. (see "Additional Information...", below). Both materials exclude moisture condensation in the treated area and have been effective for preventing this problem. Duniway Stockroom Corp. can provide both of these products..



**Phone: 800-446-8811 or 650-969-8811**

**FAX: 650-965-0764**

**web: [www.duniway.com](http://www.duniway.com)**

## Additional Background Information and Applications

“Polyphenyl Ethers (PPEs) first found commercial applications as high temperature lubricants and corrosion blockers in the engine turbines of the SR-71 spy aircraft, where operating temperatures of 316° C (600° F) would oxidize or decompose other hydrocarbon molecules. At the other extreme, they can remain in liquid form in temperatures below 0° C, where rigid molecules would pack tightly and become a solid. Their consistent performance across wide temperature ranges opened up such applications as lubricants on space satellites and as fluids in vacuum diffusion pumps—where they were selected for very low vapor pressures in the range of  $4 \times 10^{-10}$  torr.

### Anti-Corrosion Performance In Electrical Application

On the pins of electronic connectors, where they are used as lubricants and corrosion blockers, their lifetime is between 40 and 50 years. Applied to gold, tin/lead and other electronic metals, PPEs virtually eliminate metal wear and prevent fretting or galvanic erosion by capturing or blocking corrosive particles on the connector surface or in the atmosphere.”

(excerpted from “Polyphenyl Ethers: Old Material Has New Benefits for Photonics” by Dr. David S. Stone and Manuel E. Joaquim, Photonics Spectra, April 2002, pp 90-92)