

## Technical Position on Use of PEI Polymer Retaining Ring

### Summary

The new FlexBowl™ filter pressure vessel system is constructed of chemically resistant components and can be used in virtually every aggressive wet chemical application encountered in microelectronics manufacturing. A unique feature of the FlexBowl vessel system is that the manifold can accept either housings or capsules in a variety of sizes and materials. This design requires the use of a retaining ring, which must have chemical resistance, temperature resistance, and strength properties greater than those possible using conventional fluoropolymer materials. Since the retaining ring is a nonwetted part, the strength and thermal properties are more critical than the chemical resistance properties. Nonetheless, a special high-chemical-resistance grade of polyetherimide (PEI) that meets all of the claimed application requirements was the material selected. This report summarizes some of the testing conducted by Pall Corporation. The testing was performed to confirm the efficacy and aesthetics of the retaining ring when exposed to casual contact with selected aggressive chemicals for which PEI has limited resistance.

### Background

In any application involving aggressive chemicals (e.g., acids, bases, oxidizers, and solvents), it is critical that components of devices coming in contact with those chemicals not be significantly affected by them. Surfaces that come in contact with the chemicals are termed *wetted* surfaces. Such surfaces are vulnerable to chemical attack. In the FlexBowl system, all wetted surfaces (exclusive of seals) are constructed of perfluoropolymer, specifically perfluoroalkoxy (PFA), an exceptionally resistant and clean polymer.

Devices used with aggressive chemicals will also typically have components that do not have contact with the chemicals. For a variety



Pall FlexBowl™ housing kit.

of reasons that may be technical, economic, and even aesthetic, other materials may be used for these parts. In the FlexBowl system, the retaining ring, which securely connects the housing or capsule to the manifold, is constructed of a polymer in the polyetherimide family. This is a superior material to use for a part that has as its principal function enduring physical strength, rather than containment of aggressive liquid. This material also has the capability to withstand the repeated gripping of the retaining ring by a spanner wrench for secure closure.

System components that are not wetted by the aggressive chemicals may still be vulnerable to casual exposure (e.g., from drips, spray, or vapor) during servicing of the component or other elements of the system of which the component is a part. The PEI retaining ring, as a nonwetted component of the FlexBowl system, could experience casual contact with the chemicals. Although non-wetted surfaces are not subjected to the same conditions (e.g., continuous liquid contact, elevated temperatures and pressures, full concentration) as the wetted surfaces, we consider it

valuable to show that casual contact of the retaining ring with aggressive chemicals is not a cause for concern. Using a combination of available compatibility information and additional testing, we have demonstrated that PEI is a suitable material for the retaining ring.

### ***PEI Literature-based Compatibility Information***

Extensive compatibility information for the high-chemical-resistance PEI resins of the type used in the retaining ring is available from resin suppliers. This information shows that the material exhibits excellent compatibility with nearly every major class of chemical under conditions generally far more aggressive than those that the PEI retaining ring could encounter. The one exception is the chemical family of bases, for which the effect appears significant. This has prompted further testing of PEI material to determine specific behavior in situations that are more similar to casual contact.

### ***Compatibility Testing in Sodium Hydroxide and Ammonium Hydroxide***

- **Appearance after contact:** 0.125 inch plates of PEI resin of the type used in the retaining ring were subjected to drops of 20% sodium hydroxide and 20% ammonium hydroxide. After 8 hours of contact, there was still no change in the appearance of the PEI in either chemical.
- **Tensile strength after 48 hours of exposure:** Machined bars of PEI resin of the type used in the retaining ring were subjected to 48

hours of continuous immersion soaks in 20% sodium hydroxide. Compared to the controls, which were bars of the same grade of PEI material, those soaked in sodium hydroxide retained over 95% of the tensile strength of the unsoaked material, indicating a minimal effect.

- **Tensile strength after multiple short-duration contacts over a 96 hour period:** A different, more realistic contact test was used for ammonium hydroxide, since its effect on PEI is known to be greater than that of sodium hydroxide. Machined bars of PEI of the type used in the retaining ring were dipped in 20% ammonium hydroxide, then dried. This was done 12 times a day for four days. The purpose was to simulate occasional exposure during use. Compared to the controls, which were bars of the same grade of PEI material, those dipped in the ammonium hydroxide and dried retained over 92% of the tensile strength of the unsoaked material, indicating a minimal effect.

### **Conclusion**

Manufacturers' compatibility data, in conjunction with results from additional testing by Pall Corporation, serve to demonstrate that the use of enhanced-chemical-resistance PEI for the FlexBowl filter pressure vessel system retaining ring is appropriate. (Additional testing was conducted for the few aggressive liquids where manufacturers' information left some uncertainty about compatibility.) While chemical compatibility and suitability of the material have been clearly demonstrated, users should verify compatibility under their own specific conditions of use.



**Pall Corporation**

**Pall Microelectronics**  
25 Harbor Park Drive  
Port Washington, NY 11050

+1 516 484 3600 telephone  
+1 800 289 7255 toll free US  
microelectronics@pall.com

**Visit us on the Web at [www.pall.com/micro](http://www.pall.com/micro)**

Pall Corporation has offices and plants throughout the world. For Pall representatives in your area, please go to [www.pall.com/corporate\\_contact.asp](http://www.pall.com/corporate_contact.asp).

Because of technological developments related to the products, systems, and/or services described herein, the data and procedures are subject to change without notice. Please consult your Pall representative or visit [www.pall.com](http://www.pall.com) to verify that this information remains valid.

© Copyright 2009, Pall Corporation. Pall, , and FlexBowl are trademarks of Pall Corporation.  
® Indicates a Pall trademark registered in the USA. *Filtration. Separation. Solution.<sup>SM</sup>* is a service mark of Pall Corporation.