FLUID SEALING ASSOCIATION FSA

From the voice of the fluid sealing industry

SEALING SENSE

What are the benefits and pitfalls of ePTFE/Graphite packing?

Anyone considering the use of ePTFE/graphite packing in a plant environment needs to know its basic characteristics, including its manufacturing process and potential benefits and pitfalls. This article will serve as a primer to educate readers and help in the compression packing decision-making process.

Many of the properties of PTFE—including excellent chemical resistance and a low coefficient of friction—make it a superior material for both pump and valve packing, in both braided and solid forms. The distinction between the various braided forms, along with their advantages and disadvantages, was reviewed in a previous *Sealing Sense*. Expanded PTFE (expanded polytetrafluoroethylene), or *ePTFE*, a unique form of yarn widely used as a pump packing, was part of that review.

Expanded PTFE is processed from an extruded paste of PTFE powder and lubricant. After evaporation of the lubricant, the paste is stretched while heating to form the ePTFE yarn. One of the limitations of packing made from all PTFE yarns, including ePTFE, is its low thermal conductivity. Since ePTFE is an insulator, it imposes limits on maximum pump shaft speed because of poor dissipation of frictional heat. The process of expanding the PTFE greatly improves the strength of the fiber at less mass than the original structure. The expansion process also creates pockets of air in the microstructure that allows the impregnation of additional raw materials.

A combination of ePTFE with graphite was first introduced through a propriety process more than 25 years ago as *ePTFE/Graphite* fiber. Until that time, all materials used in packings were engineered for purposes other than compression packing, but most demonstrated some desirable packing attributes including natural lubricity and the ability to seal against the shaft and pump housing to prevent fluid leakage.

The aim of this combination was a packing material with improved thermal conductivity and shaft speed capability as compared with ePTFE. Since this original development, a number of other approaches to manufacturing ePTFE/Graphite fiber have been developed. The extent of property enhancement of these and all ePTFE packing is dependent upon the raw materials and manufacturing processes, as well as the construction of the braid.

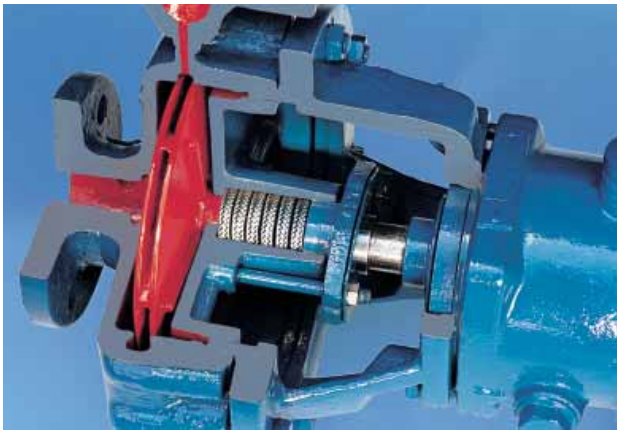

Figure 1. Sectioned view of ePTFE pump packing

Manufacturing Process

ePTFE/Graphite for braided packings is made with three components. The first is PTFE, which provides the backbone of the structure and natural lubricity to minimize friction.

The inclusion of graphite as the second material helps to solve some of the problems associated with PTFE and ePTFE. Packings made with PTFE and ePTFE are natural insulators. When the frictional forces associated with packing begin to generate heat, this heat is trapped near the shaft. This causes the packing to harden and become abrasive to the shaft. During replacement of the packing, the shaft or shaft collar often needs to be replaced. This problem is solved by graphite and its excellent thermal properties and helps promote heat transfer away from the shaft, which extends the life of the packing and pump.

The final material is a lubricant such as silicon oil. The lubricant helps to minimize friction during start-up and break-in. The inherent ePTFE structure helps the fiber capture and retain lubricants.

One important factor to consider is how these materials are integrated into the structure. Packings with graphite and lubricant dispersed throughout, instead of coated on the surface, will enable the packing to perform more effectively for a longer time.

Benefits

Since ePTFE/graphite was originally developed specifically

for packing, its properties have been optimized for reliable sealing, as well as ease of braiding and installation. The benefits of ePTFE/Graphite packing include:

- **Installation/Removal**—The flexibility and stability of the ePTFE backbone prevents installation problems.
- **Sealing performance**—The combination of ePTFE and graphite delivers superior sealing and long service life due to the flexibility and strength offered by the ePTFE and the thermal properties offered by the graphite.
- **Chemical Resistance**—ePTFE/Graphite packing can be used across the 0 to 14 pH range except with strong oxidizers, fluorine, molten fluorides and a few others.
- **Versatility**—This packing can be used in a wide range of pump and valve sealing applications and service conditions including shaft speeds of 20-m/s. Applications include rotary pumps, centrifugal pumps, soot blower, mixers and any valve seeing temperatures less than 288-deg C.

Pitfalls

ePFTE/graphite packing, like any packing, has potential pitfalls to consider:

- **High Temperature**—ePTFE/Graphite packings are generally not recommended for temperatures above 288-deg C (550-deg F).
- **Abrasive Applications**—ePTFE/Graphite packings do not perform well in abrasive applications. Consider using a corner reinforcement material.
- **Packing Composition**—ePTFE/Graphite packings that use a surface coat will not perform as well as those that impregnate the materials. The surface coat can be washed away, which limits performance.

Conclusion

ePTFE/Graphite packing tolerates a wide range of service conditions and has the capabilities inherent in PTFE while overcoming limitations of low thermal conductivity. These characteristics of ePTFE enable standardization of packing to simplify operations and improve productivity in many cases. To ensure proper choice and application of any ePTFE packing, it is always advisable to consult your packing manufacturer.

Next Month: *Where mechanical seals meet pumps: What is the next generation?*

We invite your questions on sealing issues and will provide best-effort answers based on FSA publications. Please direct your questions to: sealingquestions@fluidsealing.com.

P & S

Fluid Sealing Association

Sealing Sense is produced by the **Fluid Sealing Association** as part of our commitment to industry consensus technical education for pump users, contractors, distributors, OEMs and reps. *This month's Sealing Sense was prepared by FSA Member Matthew Rosa.* As a source of technical information on sealing systems and devices, and in cooperation with the **European Sealing Association**, the FSA also supports development of harmonized standards in all areas of fluid sealing technology. The education is provided in the public interest to enable a balanced assessment of the most effective solutions to pump technology issues on rational total Life Cycle Cost (LCC) principles.

The **Compression Packing** division of the FSA is one of five with a specific product technology focus. As part of their mission they develop publications such as the joint FSA/ESA *Guidelines for the Use of Compression Packings* and *Pump & the Valve Packing Installation Procedures* pamphlet. These are primers intended to complement the more detailed manufacturer's documents produced by the member companies. In addition to English, they are available in a number of other languages, including Spanish and German.

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