What is new in braided packing technology?

Packing technology has developed rapidly through the years. Packings have historically evolved from the simple, lubricated, square braided, asbestos commodity material to a more complex, diagonally braided design made from high-tech materials specifically designed for application requirements. Today, packings can be constructed from the same aramid fibers used on bulletproof vests and carbon fibers used in the aerospace industry.

Construction

Sophisticated braiding machines capable of producing inter-braided packing designs have advanced packing technology. These machines produce packings that are cross-braided, or diagonally braided, because of the path that the carriers make. They move diagonally from one surface to the other through the body of the packing. This braiding method allows manufacturers to control and modify the packing density, so the packing will better adjust to different service requirements. Diagonally braided packings have a solid structure that will not unravel in service.

Figure 1. Typical PTFE packings

Materials

The evolution of synthetic fibers and filaments has also played a major role in improving packing performance. Dozens of new materials can be used for a wide range of applications. PTFE and carbon/graphite filaments are the most prevalent due to their high chemical and thermal resistance.

The high strength of the carbon-fluorine bonds in polytetrafluoroethylene (PTFE) contributes to the chemical inertness of this synthetic polymer, making it resistant to nearly all fluids and gases including the most corrosive acids and alkalis. PTFE is remarkably lubricious, reducing wear on shafts and stems and energy consumption of machinery.

Expanded polytetrafluoroethylene (ePTFE) is a unique braided packing material. The process of expanding the PTFE greatly improves fiber strength. The expansion process also creates pockets of air in the micro-structure. This micro-structure makes ePTFE fiber highly conformable and more accepting to lubricants and other impregnants. This fiber also meets FDA requirements for use in the food and pharmaceutical industries.

Figure 2. Typical graphite packings

ePTFE/graphite fiber packings are a later development to improve ePTFE properties through the combination of two major components. PTFE is the backbone for the fiber and provides natural lubricity to minimize friction, while graphite has good thermal properties and helps to maximize heat transfer.

Impregnants and Lubricants

Another important aspect in packing evolution is the development of more effective impregnants. The impregnant fills all the voids between the interbraided yarns.

There are several ways to introduce these impregnants into the packing. They can be applied directly to the yarn prior to braiding, during braiding, after braiding or at all three of these stages. An aqueous dispersion of colloidal PTFE is a commonly used impregnant. This impregnant is also a good lubricant and can be used to modify some of the fiber characteristics as well as add new desirable ones.

Lubricants are available in all types and forms, from liquid to solid, from natural to synthetic, etc. For example, the lubricant often employed in ePTFE/graphite packing is silicone oil. Lubricant helps to minimize friction during start-up and break-in. The lubricant should always be compatible with the packing application.

Applications

Many of today's packings allow pumps to operate with virtually no leakage. These "self-lubricating" packings—usually made from graphite—show good flexibility and heat dissipating properties, low coefficient of friction and excellent chemical and thermal stability. Some high performance packings have high thermal stability that allows them to undergo extreme situations such as exposure to flame environments. The ANSI/API Standard 607 (ISO 10497-5) for Fire Type-Testing Requirements describes a fire test for valves in which packing thermal resistance can be evaluated.

As applications become more complex, it is not always possible to use only one type of packing. In many cases, combination sets are recommended with two or more packing ring types. These combinations can be used when there is a need for soft packing that might extrude at the bottom of the stuffing box into the media or into the gland follower side. To prevent this from happening, stronger pressure resistant anti-extrusion rings are used on the top and bottom of the set. Combination sets are also used with abrasive media where rings with abrasion resistance are used on the media side to prevent abrasive particles from entering the stuffing box.

Conclusion

New packings, as well as application methods, are continuously engineered to meet industry's increasing demands for performance and environmental compliance. Packings, fibers and lubricants will continue evolving, and proper packing selection will be an increasingly important task. It is always best to contact the manufacturer to ensure proper selection and application of pump and valve packing.

Next Month: *Is there a new way to monitor fugitive emissions?*

We invite your questions on sealing issues and will provide best efforts answers based on FSA publications. Please direct your questions to: sealingsensequestions@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 Carlos Girao.* 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 new joint FSA/ESA *Compression Packing Technical Manual* 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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