Unsuitable Usage Conditions of Gaskets and Countermeasures

1. Introduction

The term "gasket corrosion resistance" means the ability of a gasket to resist corrosive fluids including acidic and alkaline fluids. It also sometimes refers to countermeasures for events that could occur with given fluids. To address such events, not only seal materials themselves, but also proper selection and application of seal materials are important. This report introduces examples of such events and countermeasures.

2. Examples of Troubles and Countermeasures

2-1) Blooming phenomenon of resin-type gaskets caused by polymerizable monomers

The phenomenon of blooming occasionally occurs in the fluororesin jacketed gasket: No. N 7030 series and the filler-added fluororesin gaskets: No. 7020, No. 7026, and No. GF300 series. Chemical reaction between the constituent materials and fluid is not considered to cause this phenomenon. In addition, the results of analyzing affected gaskets, which revealed the involvement of a material not contained in the gaskets, and the morphology of affected gaskets, suggest that the phenomenon might be caused through the following mechanism: monomeric fluid permeates the inside of a gasket; the permeating fluid causes polymerization inside the gasket; the polymerization results in volume expansion; and the expansion causes the gasket to break.

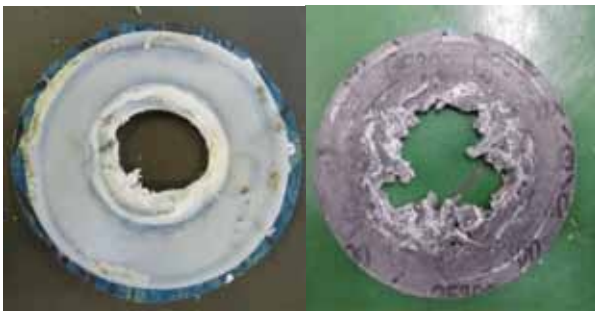

Figure1　Blooming phenomena of a resin-type gasket

To address these problems, it is recommended to change to a spiral wound gasket (No. 7596V), which does not break when fluid permeates and polymerizes, and to use gaskets made of PTFE only which are less likely to cause permeation. Also, inadequate tightening is possible o cause permeation, so proper tightening can be a countermeasure in some cases.

2-2) Chemical degradation of a core joint sheet caused by permeation of strong acids into the PTFE jacket of the N 7030 series

Because of PTFE jackets, PTFE jacket gaskets are superior in chemical resistance to joint sheets. However, PTFE could permeate some chemicals when a PTFE jacket gasket is used for a long period. The PTFE may occasionally allow fluid, especially hydrochloride, to permeate the gasket's core and affect the core. If that happens, the following events may occur: fluids accumulate into the inside of the PTFE jacket and the inner core; traces of permeation including discoloration are observed; and fluid contents are detected by analyzing the inside of the core. As countermeasures, it is recommended to increase the thickness of the PTFE jacket and to change the gasket material (for example, to use the PTFE blended gasket No. MF300 and the spiral wound gasket containing PTFE filler).

2-3) Decomposition of expanded graphite caused by oxidation using the gasket above the recommended temperature

As a seal material, expanded graphite has ideal properties including excellent chemical resistance and low creep relaxation, but when the temperature is 450°C or higher, its oxidation reaction with oxygen in the air usually causes gasification, which transforms the content into carbon monoxide, carbon dioxide, etc., resulting in fade-out. Therefore, recommended ranges of temperature are maximum 400°C for the graphite sheet gaskets: No. VF-30 and No. VF-35E, which are comprised of carbon only and are significantly affected by temperature, and maximum 450°C even for the spiral wound gasket containing expanded graphite filler of the No. 6590 series because of the structural advantage. When those gaskets are used at temperatures above the recommended range, leakage occurs due to loss of the constituent material in a relatively short time. In the case of spiral wound gaskets, placing non-asbestos filler or mica filler along the inner and outer periphery blocks oxygen contact, inhibits oxidation decomposition, and maintains sealing functions at 450°C or higher. Although non-asbestos filler loses organic constituents at high temperatures, usually, inorganic constituents will not change. Therefore, during non-asbestos filler remains within hoops, it prevent expanded graphite from oxidation because of oxygen shielding effects.

Figure2 Oxidation loss of expanded graphite from a spiral wound gasket

2-4) Leakage of heat transfer oil through gasket

Oils and fats used as heat media are generally designed to have a low viscosity so as to flow smoothly and efficiently. It means they are easy to permeate into gaskets. In general, expanded graphite itself shows lower coefficient of thermal expansion and thermal stability, and could be highly suitable material for seal. However, expanded graphite shows relatively poor resistance in permeation and sometimes it results in leakage through the sheet gaskets.

In general, permeation through materials could be decreased with increasing density by compression, so it could be a countermeasure to generate tightening load to suitable for sealing. For trustworthy sealing, changing to spiral wound gaskets containing expanded graphite filler such as the No. 6590 series is recommended.

2-5) Chemical degradation of a joint sheet gasket in applying to solvent (acid/alkaline) process line

When a gasket is used for a fluid for which it does not have enough resistance, the resulting fade-out or dissolution of some constituent materials make the gasket more fragile and softer, leading to reduce tightening stress and other phenomena. These events can readily be determined by analyzing used products. In these problems, it is especially dangerous that a gasket breaks so markedly that it does not keep its original shape.

As a countermeasure, it is recommended to change to gaskets, such as No. UF300, which have more resistant to fluid.

2-6) Erosion of soft gaskets caused by slurry fluid

When a gasket looks severely broken in appearance but has no tightening problems, and an analysis of a used product shows no chemical deterioration caused by fluid and heat, even if it is very rare case, physical fracture by erosion from fast-moving powder crashing against the gasket could be considered. Although the fluid's properties and the channel's design influence the erosion, erosion usually occurs in slurry fluids which contain fine particles.

As a countermeasure, it is effective to place constituent materials that have adequate resistance

against erosion inner side of gasket such as spiral wound gasket with inner ring or sheet gasket with grommet.

Figure3　Erosion of a soft gasket

3. Conclusion

We introduced a part of cases of gasket corrosion troubles and countermeasures. We hope this report will help you to select and determine seal products to solve leakage problems and achieve the required sealing.

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