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EXPANDED PTFE GASKET MATERIAL PERFORMANCE VARIATION WITH THICKNESS

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ABSTRACT

Polytetrafluoroethylene (PTFE) is an excellent gasket material, chemically, but it has relatively poor mechanical performance. As a result, much effort has gone into improving the mechanical performance of PTFE-based gasket materials. Methods to improve mechanical performance include the addition of fillers (glass fibers, glass microspheres, silica, barium sulfate, carbon, etc.) and the manipulation of the microstructure (micro cellular, expanded, restructured, etc.). These various forms of PTFE materials can have widely varying mechanical performance. PTFE materials that are chemically the same will have significantly different mechanical performance if the manufacturing process and microstructure are different. An example is the performance of amorphous, virgin PTFE sheet compared to the performance of fibrillated, expanded PTFE (ePTFE) sheet. The thickness of a gasket material is another structural difference that results in different mechanical performance.

This paper is an extension of PVP2022-84765, PTFE Gasket Material Performance Variation with Thickness [1], which investigated barium sulfate filled, restructured PTFE's mechanical performance. This paper explores the difference in the mechanical performance of common expanded PTFE (ePTFE) materials that are often considered to be functionally the same by end users. The mechanical performance of each material is compared for different thicknesses using the Hot Blowout, Thermal Cycling test (HOBTC, ASTM WK61856 Rev 10-9-2020). [2] The authors selected these thicknesses for performance review because of their usage in industry. ePTFE sheet is most commonly used on vessel and equipment flanges. The thinner thicknesses considered in this paper, 1.5 mm (1/16 inch), is most commonly used in piping flanges. The two thicker sizes reviewed for this paper are 3 mm (1/8 inch) and 6 mm (1/4 inch). Because ePTFE is so conformable, it is often used on problematic flanges with irregularities in the flange faces. Hence, the 6 mm (1/4 inch) thickness is more commonly seen with ePTFE applications than with other forms of sheet PTFE gasketing. Very little test data on 6 mm (1/4 inch) thick ePTFE exists. Leakage testing is according to the Room Temperature Tightness test (ROTT, ASTM F2836) [3]. The authors primarily used lab tests for HOBTC and ROTT data with some comparison to publicly available data. HOBTC and ROTT lab tests were performed on an amtec TEMES fl.ai1 test fixture at the authors' company. This data will demonstrate to the end-user how different the mechanical behavior can be of the same ePTFE gasket material whose only obvious difference is how thick it is.

Keywords: Gaskets, Mechanical Properties, Elevated Temperature, PTFE, expanded PTFE, ePTFE, thickness, microstructure

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