Virtually unlimited creativity

Large-scale PTFE system solutions

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Substances produced and used in the chemical industry are often aggressive, toxic, flammable, or harmful. This means that emissions need to be strictly avoided. Products that have high purity requirements must be protected against contamination by metals and other materials in the plant. Components and systems made from PTFE and modified PTFE presented below have nearly universal application and long service life, and protect both the products and the environment from contamination.

Despite their relatively low mechanical strength, high coefficients of thermal expansion, and low wear resistance to abrasive media, solid plastic system solutions based on PTFE and modified PTFE are used in a wide variety of applications. Nearly unlimited design options, made possible by a broad platform of processing technologies, have been a major driver of expanded applications. They are not sensitive to small nicks and scratches, they allow weight savings in the overall system, and, thanks to their intrinsic insulation value, they often allow the elimination of separate insulation.

When aggressive media that attack even high-alloy stainless steels need to be pumped, there are often only few alternatives available. All-plastic pumps made of PTFE, or especially modified PTFE, have the advantage of being compatible with nearly any medium. A certain level of standardization has developed, even in this area, which has resulted in efficiencies of scale. In addition to the impeller and seals, the spiral housings of centrifugal pumps are machined from solid stock. The PTFE production processes now allow housing dimensions of 840 x 740 x 320 mm. Because the raw stock can be dimensionally adjusted to the final geometry, machining waste is kept within limits during production.

If the materials have high purity requirements, then plastic pumps are the only option. PTFE is necessarily produced under clean conditions. During processing, care must be taken to ensure that the powder is not subsequently contaminated. During subsequent machining, unlike thermoplastic processing, no further ion contamination takes place.

Tanks of any size

All-plastic tanks typically have a two-layer system design. The inner part, which contacts the medium, is a thick-walled fluoropolymer layer. The outer layer is made of plastic reinforced with glass or carbon fibers to provide strength. The composite system is thus able to meet requirements for thermal expansion and permeation. There are virtually no limits to size, function, or design. Their low weight is another popular advantage, especially for transport tanks. This type of construction is a mandatory prerequisite for avoiding even the slightest metal ion penetration, especially in the semiconductor industry.

Caption 1
Complex part geometries can be machined from a single piece of solid PTFE stock. Because the raw stock can be dimensionally adjusted to the final geometry, machining waste is kept within limits.

Fixtures for tanks and reactors include inlet and outlet fittings, distribution systems, stirrers, and baffles. PTFE solutions have two additional advantages: First, a wide variety of processing technologies (especially welding of modified PTFE) can be used. Second, the resistance of the material can be used to full advantage in the presence of ongoing chemical reactions. The total aggressivity potential ultimately acting on the material is an interaction of individual phenomena: The effects on materials of nascent media that occur during chemical reactions often cannot be calculated, and only fully fluorinated PTFE materials have sufficient resistance.

Fixtures for distillation columns

Solid PTFE works well for distillation column bubble trays, due to its exceptional corrosion resistance. The multifaceted design options for vapor guidance and backflow devices can also increase the theoretical plate number, and thus optimize separation. The construction of the bubble trays is reinforced by customized filling material inserts to withstand high fill load strength and high specific surface area at minimum weight.

The optional installation of hermetically sealed reinforcement elements also allows self-supporting spaces to be spanned, for columns with large diameters. Fixtures made of modified PTFE have also proven themselves, especially in the preparation of high-purity chemicals, such as hydrofluoric acid. The three-dimensional contours of column plates are machined from modified PTFE, in particular, using special machining technology. Hermetically sealed, integrated reinforcement elements expand the self-supporting span of the cross section even further. This makes it possible to meet the specifications of the process engineers without compromise.

Caption 2

Seals up to 3 m in diameter can be machined from a single piece. Compounds based on modified PTFE, in particular, have proven themselves as materials.

Static seals

Static seals made of PTFE materials are the preferred choice in chemical plants. The main goal is to combine good adaptability at the flange and high sealing performance with good pressure holding capacity, to prevent blow-outs. These initially contradictory requirements can be met by various system solutions:

Compounds based on modified PTFE with low filler content: they combine the low cold flow values of modified PTFE with the slight disturbance functions of low filler content, and are therefore particularly tight and have good adaptability.

Dual-material shell seals: the chemical resistance and low permeation of modified PTFE is combined with relatively soft filler inserts.

Hermetic seals include bellows and membranes. The property of extreme bending fatigue strength of unfilled PTFE leads to long service life for a properly designed component. Plastics manufacturer ElringKlinger Kunsttofftechnik has a modified PTFE available that exceeds all previously known parameters for bending fatigue strength by a factor of 3 to 10. Combined with the familiar advantages of PTFE, excellent solutions can be achieved. These design elements are typically used in pumps, valves, regulators, and sometimes in actuators as well. Compensators are actually quasi-static seals with only limited motion.