

CHEMICAL RESISTANCE AGAINST H_2SO_4

PVDF and ECTFE used for sulphuric acid

Description of sulphuric acid

- Chemical resistance
 - Material properties
 - Effects of chemical media
 - Resistance against various media
 - Case studies
- slightly yellow viscous liquid (oil of triviol)
 - soluble in water at all concentrations
 - Diprotic acid
 - Corrosive due to its
 - strong acidic nature,
 - strong dehydrating property
 - strong oxidizing property (concentrated acid)

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Resistance of PVDF against sulphuric acid

Temperature [°C]	Maximal admissible concentration of H_2SO_4
23	96,3
50	93
100	85
120	80
150	70 (no pressure)

Information based on chemical resistance tests of the raw material supplier

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Resistance of PVDF against sulphuric acid

- Brown discoloration
- Permeation

H ₂ SO ₄ Concentration	Temperature	Hoop stress σ max	Time at rupture	H ₂ O σ max without rupture MPa	f _{CR}
%	°C	MPa	hours		
97	50	10	54700	23	0.43
96		18	37650		0.78
93		18	> 54900 *		0.78
96	100	1	8600	12.5	< 0.1
93		4	7900		< 0.3
90		6	> 9200		0.48
80		11	54530		< 0.88
93	120	3	296	9.5	< 0.1
80		9	> 17500 *		0.94
90	150	2	1825	5.5	< 0.1
80		5	> 1700		(0.91)
70		4	> 30000		0.72

$$f_{CR} = \sigma_{H_2SO_4} / \sigma_{H_2O}$$

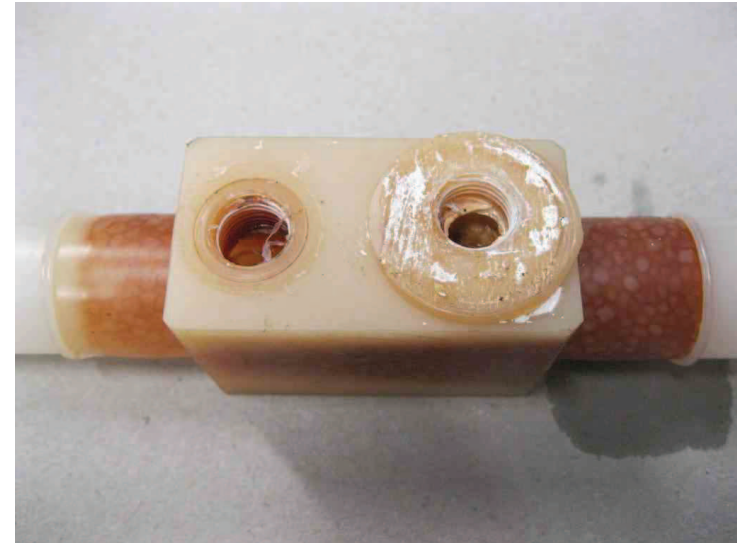
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Sulphuric acid – brown discoloration



Test criteria:
200 h at 95°C $\sigma=11,5 \text{ N/mm}^2$
Stopped after 240 hours

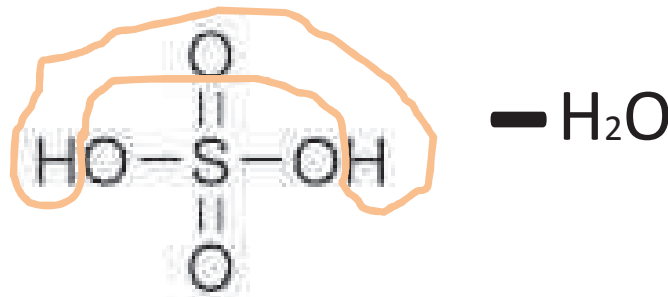


Burst pressure
20°C; 0,08 bar/sec
98 bar

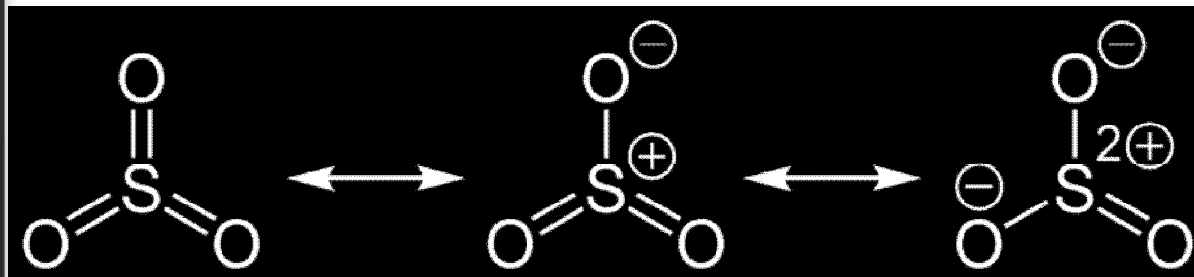
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CHEMICAL RESISTANCE AGAINST H_2SO_4

High concentrated sulphuric acid (concentration: >96,3%)



Sulfur trioxide (SO_3)



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Resistance of PVDF against sulphur trioxide, which is formed by sulphuric acid >96,3%

- Deshydrofluorination
- Permeation
- Increase in weight (>5%)
- Stress cracking corrosion
- Typical phenomenon if SO_3 only is present in very small amounts
- Physical and chemical degradation

ECTFE is resistant against sulphuric acid with a concentration >96,3% without any restrictions

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CHEMICAL RESISTANCE AGAINST H_2SO_4

Medium: sulphuric acid 98%

Temperature: 20°C



Medium: sulphuric acid 96%

Temperature: 20°C – 30°C



- Chemical resistance
- Material properties
- Effects of chemical media
- Resistance against various media
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CHEMICAL RESISTANCE AGAINST H_2SO_4

Medium: sulphuric acid 98%

Temperature: 20°C



The solution



ETHYLENCHLORTRIFLUORETHYLEN - ECTFE

