Corrstop® Dual Laminate Thermoplastic Lined Steel

Composites USA
A Critical Process Systems Company

For elevated temperatures and pressures, Thermoplastic Lined Steel (TLS) may offer the best solution to process corrosion problems. Ultra pure applications that are found in the pharmaceutical and semiconductor industries often require mechanical designs better suited to alloys than composites. TLS offers a cost effective alternative to high nickel alloys for these applications in the same way Dual Laminate composite fabrication addresses corrosion and purity issues at lower temperature and pressures.

TLS is offered in three distinct forms: a non-bonded or loose liner, a mechanically attached liner, and an adhesive bonded liner. The service conditions dictate which form is best suited to the application, and Composites USA can assist in this determination.

Composites USA can provide a complete lined steel equipment package, or we can line customer supplied steel equipment. If customer provided, Composites USA personnel can assist with the specifications and fabrication inspections required for the steel equipment to insure a design that is best suited for thermoplastic lining.

Reinforced Thermoset Plastic Lined Steel Equipment

Thermoset Plastic Lined Steel Equipment is often a cost effective alternative to TLS where corrosion and purity requirements do not dictate the use of a thermoplastic, but where carbon steel is unsuitable for the application.

Continued advances in materials of construction are expanding uses for reinforced thermoset plastic (RTP) lined equipment. Delamination, which can occur due to the vast differential between RTP and steel coefficients of thermal expansion, has been greatly reduced by advances in elastomeric resins. Resin reinforcement has also changed with the advent of a fluoropolymer-surfacing veil (Halar Veil). This veil allows for a higher concentration of reinforcement to resin ratio, without sacrificing chemical resistance, which makes the corrosion barrier less susceptible to crazing and cracking.

Typical Liner Material Properties

Mechanical Properties	ASTM	Unit	PVC	CPVC	PP	PVDF	PVDF AS	ECTFE	ETFE	FEP	PFA	RTRP Typical
Specific Gravity[1]	D792	See Note 2	1.32	1.55	.91	1.76	1.78	1.69	1.70	2.15	2.15	1.12
Tensile Strength[1]	D638	psi (SI)	6300 (45)	8000 (55)	5000 (33)	7111 (50)	4900 (32)	6400 (45)	6250 (44)	3400 (25)	3840 (27)	18000
Tensile Modulus[1]	D638	psi (SI)	360000 (2500)	360000 (2500)	170700 (1200)	341400 (2400)	250000 (1750)	241800 (1700)	156500 (1100)	60500 (425)	39800 (280)	1550000
Flexural Modulus[1]	D790	psi (SI)	415000 (2860)	415000 (2860)	200000 (1406)	320000 (2250)	241800 (1700)	241800 (1700)	184900 (1300)	98900 (660)	98900 (660)	1150000
Flexural Strength[1]	D790	psi (SI)	15100 (104)	15100 (104)	6685 (47)	10525 (74)	6381 (44)	6258 (44)	5500 (39)	2560 (18)	2560 (18)	23000
Hardness	D2240	Shore D	80	80	73	77	77	75	67	56	60	
Elongationat break[1]		%	20-30	20-30	20-300	20-80	15	200	200	299	300	
Thermal Properties												
Maximum Service Temp		**	140 / 60	190 / 90	200 / 94	300 / 149	250 / 120	300 / 149	300 / 149	400 / 205	500 / 260	300
Linear Thermal Exp. Coef.[3]	D696	°F	35	35	85	70	80	40	75	50	70	18
Heat Melt Point		°F	220	230	330	342	315	465	515	525	590	N/A
Distortion Temp.	D648 @ 264 psi		135	180	107	235	150	170	270	118	118	200-280
Fire Class	UL 94		V-O	V-O	HB/V-2	V-O	V-O	V-O	V-O	V-O	V-O	

Corrosion Resistance Properties

Table 1: Corrosion Resistance of Typical Thermoplastic Liner Materials

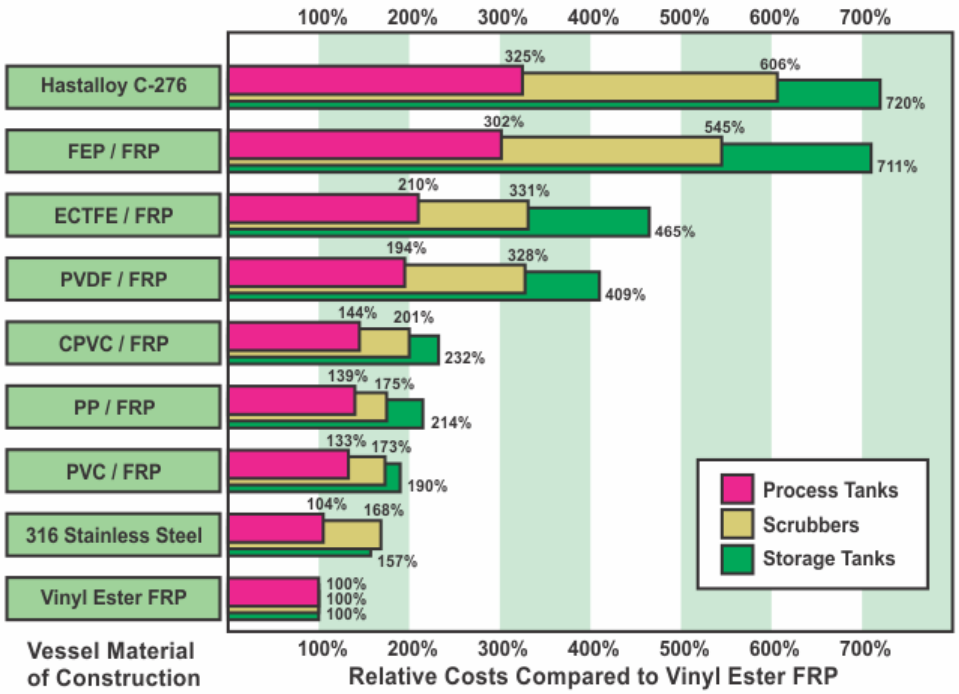
		PVC	CPVC	PP	PVDF	ECTFE	ETFE	FEP	PFA
HCl, <36%	°F	104	180	140	285	300	300	300	300
	°C	40	82	60	140	149	149	149	149
HCl, 36%	°F	NR	73	63	285	300	300	300	300
	°C		23	20	140	149	149	149	149
Sulfuric Acid, 100%	°F	NR	NR	NR	NR	73	120	300	300
	°C					23	50	149	149
Sulfuric Acid, 98%	°F	NR	73	NR	150	250	300	300	300
	°C		23		65	120	149	149	149
Sulfuric Acid, >50%	°F	104	180	140	250	250	300	300	300
	°C	40	82	60	120	120	149	149	149
Nitric Acid, 70%	°F	NR	73	NR	121	121	75	300	300
	°C		23		50	50	25	149	149
Nitric Acid, 35%	°F	NR	73	63	121	212	150	300	300
	°C		23	20	50	100	65	149	149
Sodium Hydroxide, 50%	°F	140	180	212	NR	250	230	300	300
	°C	60	82	100		120	110	149	149
Sodium Hydroxide, 10%	°F	140	180	212	120	300	230	300	300
	°C	60	82	100	50	149	110	149	149
Sodium Hypochlorite, 12.5%	°F	104	180	63	200	250	300	300	300
	°C	40	82	20	95	120	149	149	149
Hydrofluoric Acid, 70%	°F	NR	NR	NR	200	212	250	300	300
	°C				95	100	120	149	149
Hydrofluoric Acid, 40%	°F	104	160	140	250	250	275	300	300
	°C	40	70	60	120	120	130	149	149

NR = Not Recommended

The information in this table has been provided by thermoplastic manufacturers.

Overall Cost Comparison

Table 3: Cost Comparisons of Typical Vessel Configurations



Composite & Metal Products, USA, Inc. | One Peninsula Drive, North East, MD 21901 | T: 410.287.2700 | F: 410.287.5222