

Materials & Metallurgy Team

MATERIALS TEST REPORT

Westec TPE Rubber and TPO

Waterstop in Ozone

by:

William Sleeper

January 2002

BACKGROUND

Current specifications for waterstop in ozone contactor construction is 316 stainless steel. The 316 stainless steel was selected as the standard based on the fact that little information exists on the performance of plastics and elastomers in ozone environments, PVC doesn't appear to have long term satisfactory performance in ozone environments and that stainless steel waterstop is the standard in Europe.

As a result of the lack of information regarding materials performance in ozone environments, Materials & Metallurgy Section has been studying materials performance in ozone through the use of a pilot plant located in . The most recent phase of the study looked at several waterstop materials with the potential for use in ozone contactor construction. This materials test report details the results for the waterstop tested in this current testing phase.

INTRODUCTION

Two vendors submitted waterstop materials with a reported resistance to ozone for testing and evaluation. These materials are Thermoplastic Elastomeric Rubber (TPE Rubber) and Thermoplastic Olefin (TPO) submitted by Westec Barriers and a TPE Rubber submitted by . These materials were fabricated into test specimens consisting of dumbbells conforming to ASTM A412.

TEST PROCEDURE

Five each of the test specimens were exposed to various ozone environments for a period of one year and removed for evaluation. The four environments of exposure consisted of the ozone contactor with an ozone residual in excess of 4 ppm, the side-stream with an ozone residual of 0.4 ppm, the off-gas with an ozone in oxygen concentration in excess of 1 wt/o and the finished water stream with no ozone.

Upon removal, the test specimens were evaluated visually and shore hardness readings were taken. Finally, the specimens were destructively tested to determine their post exposure ultimate tensile stress for comparison against a set of control samples.

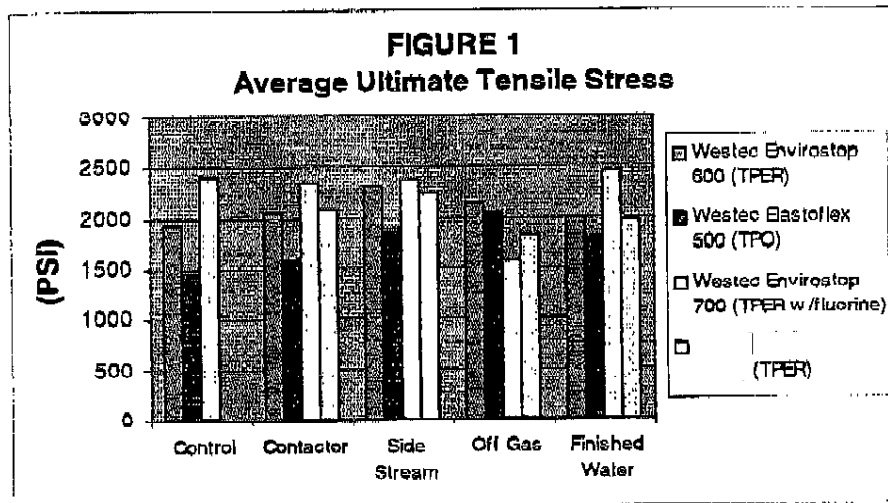
TEST RESULTS

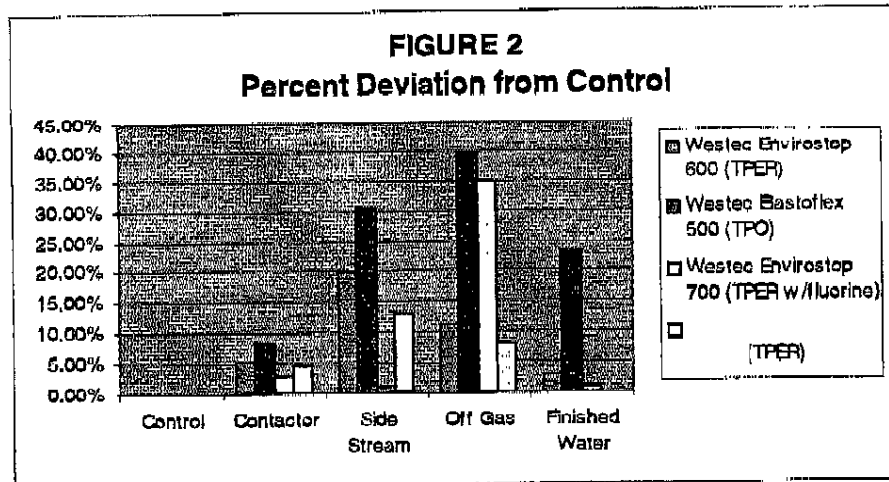
Visual observations are recorded in table 1 and shore hardness results are presented in table 2. Figures 1 and 2 illustrate the tensile test results.

Visual observations consist of a post exposure evaluation for tackiness, surface erosion, surface appearance and cracking, and strain induced cracking with or without bleed water.

	Contactor	Off-Gas	Side-Stream	Finished Water
Westec Elastoflex 500 (TPO)	Stained reddish brown.	White deposits.	Light gray deposits.	White deposits.
Westec Envirostop 600 (TPE Rubber)	Discolored and stained gray brown.	White deposits.	Light gray deposits.	Light gray deposits.
Westec Envirostop 700 (TPE Rubber with Fluorine)	Reddish brown spots.	Slight reddish-brown deposits and slight surface cracking on extension.	No changes noted.	No changes noted.
(TPE Rubber)	Gray deposits.	White deposits.	Light gray deposits.	Minor deposits.

	Control	Contactor	Off-Gas	Side-Stream	Finished Water
Westec Elastoflex 500 (TPO)	30 (95)	38 (96)	36 (86)	37 (94)	38 (97)
Westec Envirostop 600 (TPE Rubber)	34 (93)	35 (94)	39 (95)	38 (95)	35 (93)
Westec Envirostop 700 (TPE Rubber with Fluorine)	37 (94)	42 (95)	45 (95)	38 (97)	38 (95)
(TPE Rubber)	no data	38 (96)	38 (95)	38 (96)	34 (97)





DISCUSSION

Visually the waterstop in each of the environments appeared to be in good condition. Upon stretching the specimens, microcracking was evident in the Westec Envirostop 700 exposed to ozone off-gas. This was further supported by the reduced hardness and ultimate tensile strength compared with the control sample and to the specimens exposed to the other three environments.

The other two Westec products, Westec Envirostop 600 TPE Rubber and Westec Elastoflex 500 TPO, had relatively higher average tensile strengths as indicated in figures 1 and 2. The difference can be considered sample population variance.

The closest spread in the tensile strength was experienced by the TPE Rubber. The comparison is based on the specimens exposed to the finished water which in this case is considered the control sample.

Based on the testing and evaluations it appears that the three products mentioned above are adequate for the service conditions imposed in an ozone contactor.

RECOMMENDATIONS

Westec's Envirostop 600 TPE Rubber and Elastoflex 500 TPO, and TPE Rubber waterstop is recommended as an alternative to stainless steel waterstop in ozone contactor construction as part of Oxidation Retrofit Program. In order to simplify the specifications and for competitive bid purposes, it is further recommended that Engineering Design focus on specifying TPE Rubber as the standard.

Westec Envirostep 600 (TPER)

	Width	Thick	Max Load	Max Stress
T00-1	0.243	0.171	85.69	2062.18564
	0.249	0.171	64.46	1513.89182
	0.251	0.17	80.24	1880.47809
	0.251	0.17	80.21	1879.77502
	0.251	0.17	99.7	2336.53621
		AVE		1934.57336
T01	0.241	0.169	91.27	2240.90943
	0.236	0.167	80.21	2035.16695
	0.236	0.256	87.88	1451.27119
	0.238	0.16	79.06	2076.15546
	0.236	0.16	90.2	2368.77119
		AVE		2038.45484
T02	0.25	0.162	85.85	2119.75309
	0.245	0.162	95.46	2405.13983
	0.24	0.161	93.15	2410.71429
	0.242	0.164	93.18	2347.81294
	0.246	0.165	93.4	2301.05937
		AVE		2316.8959
T03	0.244	0.161	84.72	2156.6032
	0.245	0.167	91.68	2240.743
	0.245	0.166	85.83	2110.40079
	0.248	0.164	87.89	2160.94611
	0.246	0.162	83.7	2100.271
		AVE		2153.79282
T04	0.246	0.168	88.05	2130.51684
	0.248	0.163	64.08	1585.19691
	0.248	0.162	86.66	2157.00916
	0.244	0.166	81.5	2012.14695
	0.247	0.167	85.93	2083.20202
		AVE		1993.81438

Westec Elastoflex 500 (TPO)

	Width	Thick	Max Load	Max Stress
B00	0.245	0.168	63.44	1559.87214
	0.264	0.172	68.86	1516.47287
	0.253	0.168	64.51	1517.73951
	0.253	0.171	58.36	1348.95869
	0.253	0.169	58.17	1360.47899
		AVE		1460.70444
B11	0.241	0.168	59.01	1457.46888
	0.24	0.162	80.19	2062.5
	0.241	0.157	55.28	1461.00378
	0.238	0.162	65.21	1691.30615
	0.247	0.159	48.94	1246.14875
		AVE		1583.68551
B12	0.255	0.144	74.85	2038.39869
	0.252	0.144	79.92	2202.38095

	0.256	0.139	55.81	1588.40153
	0.251	0.143	71.01	1978.88019
	0.24	0.141	58.74	1735.8156
		AVE		1904.67539
B13	0.241	0.146	75.49	2145.45558
	0.242	0.142	56.64	1648.23653
	0.247	0.144	81.02	2277.89024
	0.251	0.145	74.85	2056.60118
	0.252	0.143	74.55	2068.76457
		AVE		2039.38962
B14	0.243	0.163		
	0.262	0.171	78.68	1825.66085
	0.249	0.169	73.58	1748.53259
	0.248	0.164	78.28	1924.66562
	0.254	0.169	72.43	1687.32237
		AVE		1796.59538

Westec Envirostop 700 (TPER w/fluorine)				
	Width	Thick	Max Load	Max Stress
100	0.232	0.22	119.5	2341.30094
	0.239	0.206	123.4	2506.39802
	0.24	0.228	129.7	2370.24854
	0.236	0.21	122	2461.66263
	0.232	0.208	116.1	2405.91844
		AVE		2417.10571
121	0.239	0.197	118.4	2408.51283
	0.235	0.179	100.3	2384.40509
	0.241	0.225	124.9	2303.36581
	0.23	0.178	91.46	2234.00098
	0.232	0.192	108	2379.66954
		AVE		2341.99077
122	0.23	0.187	99.49	2313.18298
	0.235	0.201	104.6	2214.46962
	0.237	0.193	110.1	2407.03089
	0.233	0.195	112.5	2476.06471
	0.235	0.175	104.2	2533.7386
		AVE		2388.89536
123	0.24	0.203	81.53	1673.44007
	0.245	0.188	74.63	1620.2779
	0.232	0.183	68.86	1621.91445
	0.241	0.177	62.2	1458.14286
	0.232	0.185	64.35	1499.30103
		AVE		1574.61526
124	0.23	0.198	116.6	2560.38647
	0.245	0.198	117.8	2428.36529
	0.241	0.185	108.9	2442.52551
	0.236	0.2	112.7	2387.71186
	0.23	0.198	108.5	2406.9323
		AVE		2445.16429