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APPENDICES

Appendix A

Operational Conditions of a Continuous Stirred Tank Reactor (CSTR)

Co-monomer Loading Calculation

Table A1 Calculation of the amount of co-monomer loading for the surface modification

Monomer	Styrene	Isoprene
Mole ratio	1	3
Molecular weight	104.15	68.12
Density	0.906	0.681

Mole factor	Weight (g)		Total weight (g)	Volume (ml)	
	Styrene	Isoprene		Styrene	Isoprene
0.01621	1.688	3.3120	5	0.0147	0.0331

Pump Flow Rate Determination

Table A2 Calculation of pump flow rate for 30 min retention times of the surface modification

Reactor size	1	liter (V)
Total run volume	12.5	liters

(τ)	($v = V / \tau$)		($t = \tau / v$)		
Mean resident time (min)	Flow rate		Total run time		
	ml / sec	ml / min	min	h	h : min
30	0.556	33.33	375	6.25	6:15

Calculation is based on a ratio of 80 grams silica per liter of CTAB solution, and for one-kilogram silica modification per a run.

Appendix B

Surface Characterization Data

BET Raw Data

Table B1 BET surface area raw data with various of surfactant and initiator loadings.

Sample		BET Surface Area	
Surfactant Loading (g)	Initiator Loading (g)	m^2 / g	% Changed
146	0.4	89.62	-51.29
	0.8	92.29	-49.84
	1.65	95.44	-48.13
175	0.4	89.79	-51.20
	0.8	89.12	-51.56
	1.65	89.14	-51.55
200	0.4	143.36	-22.09
	0.8	92.34	-49.82
	1.65	90.10	-51.03
Silica Hi-Sil®255		184.00	-
Average			-47.39

Silica Hi-Sil®255 was outgas at 200°C in N_2 environment. All nine modified silicas were outgased at 150°C for at least three hours, then analyzed with program of 10 points adsorption and 10 points desorption. The calculation is based on silica Hi-Sil®255.

Particle Size Raw Data

Table B2 Particle size raw data with various surfactant and initiator loadings.

Sample			Particle size (μm)							
Monomer Loading (g/kg silica)	Surfactant Loading (g)	Initiator Loading (g)	1st	2nd	3rd	4th	5th	6th	Average	%Changed
5	146	0.4	44.61	49.83	44.07	40.49	48.42	46.94	45.73	40.10
		0.8	48.36	48.63	46.44	51.11	47.24	51.11	48.82	49.57
		1.65	75.26	76.55	77.32	82.33	75.35	77.42	77.37	137.04
	175	0.4	47.19	49.12	47.92	53.28	49.04	49.8	49.39	51.32
		0.8	46.77	49.04	51.39	54.82	51.2	55.33	51.43	57.57
		1.65	51.25	50.44	53.76	55.48	50.6	53.48	52.50	60.85
	200	0.4	44.38	40.50	39.28	41.55	42.7	44.2	42.10	28.98
		0.8	37.46	47.86	45.66	50.07	46.21	49.26	47.81	46.48
		1.65	54.30	59.38	62.15	56.30	59.21	52.11	57.24	75.37
Silica Hi-Sil®255			36.03	32.04	28.69	30.74	33.4	34.93	32.64	-
Average										60.81

Calculation of Amount of Polymer from TGA

Table B3 Calculation of the amount of polymer from TGA data of the modified silica.

Sample		TGA (%wt, loss)						
Surfactant Loading (g)	Initiator Loading (g)	Before THF extraction			After THF extraction			% Extracted polymer
		1st step* losing	2nd step** losing	Calculated polymer	1st step* losing	2nd step losing	Calculated polymer	
146	0.4	2.99	1.01	0.347	3.28	0.86	0.133	21.43
	0.8	3.02	1.57	0.900	2.65	1.01	0.422	47.80
	1.65	2.21	1.37	0.880	3.67	0.90	0.086	79.37
175	0.4	2.42	1.08	0.543	2.90	0.78	0.137	40.64
	0.8	2.46	1.59	1.045	3.41	1.34	0.584	46.06
	1.65	1.89	1.10	0.681	3.34	0.87	0.133	54.82
200	0.4	2.99	1.59	0.927	3.03	1.18	0.508	41.89
	0.8	1.97	1.03	0.593	3.27	0.81	0.085	50.83
	1.65	2.25	1.26	0.761	3.39	0.85	0.098	66.28
Silica_CTAB#		9.40	2.488					
		11.86	2.227					
Average		10.632	2.3575					

* Disappear at 180°C ** Disappear at 327°C # Chaisirimahamorakot, 2001

%wt of calculated polymer = the %wt lose at the second lose of modified silica - (the %wt loss at the first lose of modified silica / 10.632 x 2.3575)

%wt of extracted polymer = (%wt of calculated polymer at before THF extraction - wt of calculated polymer at after THF extraction) x 100

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