

FIG. 1

Table 1C. iCCD Results Showing Effects of EEDC-1 on PCAT-1.

Ex.	iCCD Results												
	Wt1	Wt2	Wt3	Tp1 (°C)	Tp3 (°C)	Mw1 (g/mol)	Mw2 (g/mol)	Mw3 (g/mol)	Mw2 /Mw3	Δ (Mw2 /Mw3) (%)	Mw1 /Mw3	Mw2/ Mw2(0)	Wt2/ Wt2(0)
CE1	0.05	0.60	0.35	29.7	99.2	13,974	41,851	122,280	0.34	0	0.11	1	1
IE1	0.04	0.60	0.36	29.7	99.4	39,583	51,677	110,264	0.47	37	0.36	1.23	1.00
IE2	0.05	0.60	0.35	29.8	99.4	43,031	61,298	123,141	0.50	45	0.35	1.46	1.00
IE3	0.05	0.59	0.36	29.9	99.6	38,902	63,975	132,680	0.48	41	0.29	1.53	0.98

FIG. 2

Table 2C. iCCD Results Showing Effects of EEDC-1 on Pre-Treated PCAT-1.

Ex.	iCCD Results												
	Wt1	Wt2	Wt3	Tp1 (°C)	Tp3 (°C)	Mw1 (g/mol)	Mw2 (g/mol)	Mw3 (g/mol)	Mw2 /Mw3	Δ (Mw2 /Mw3) (%)	Mw1 /Mw3	Mw2/ Mw2(0)	Wt2/ Wt2(0)
CE1	0.05	0.60	0.35	29.7	99.2	13,974	41,851	122,280	0.34	0	0.11	1	1
IE4	0.03	0.57	0.39	29.8	99.6	28,255	58,090	111,453	0.52	52	0.25	1.40	0.95
IE5	0.03	0.56	0.41	29.9	99.7	33,116	65,531	120,744	0.54	59	0.27	1.58	0.94

FIG. 3
Table 3C. iCCD Results Showing Effects of addition mode of components of catalyst system.

Ex.	iCCD Results												
	Wt1	Wt2	Wt3	Tp1 (°C)	Tp3 (°C)	Mw1 (g/mol)	Mw2 (g/mol)	Mw3 (g/mol)	Mw2 /Mw3	Δ (Mw2 /Mw3) (%)	Mw1 /Mw3	Mw2/ Mw2(0)	Wt2/ Wt2(0)
CE2	0.04	0.60	0.36	29.7	99.2	13,731	37,695	120,740	0.31	0	0.11	1.00	1.00
IE6	0.04	0.59	0.37	29.6	99.4	25,728	52,938	107,100	0.49	58	0.24	1.40	0.98
IE7	0.04	0.61	0.35	29.7	99.4	27,816	52,117	105,328	0.49	58	0.26	1.38	1.01
IE8	0.04	0.61	0.36	29.7	99.4	34,553	47,431	103,423	0.46	47	0.33	1.26	1.01

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FIG. 4
Table 4C. iCCD Results Showing Effects of molecular structure of EEDC on precatalyst/catalyst systems

Ex.	iCCD Results												
	Wt1	Wt2	Wt3	Tp1 (°C)	Tp3 (°C)	Mw1 (g/mol)	Mw2 (g/mol)	Mw3 (g/mol)	Mw2 /Mw3	Δ(Mw2 /Mw3) (%)	Mw1 /Mw3	Mw2/ Mw2(0)	Wt2/ Wt2(0)
CE2	0.04	0.60	0.36	29.7	99.2	13,731	37,695	120,740	0.31	0	0.11	1.00	1.00
IE9	0.03	0.59	0.38	29.8	99.4	26,316	43,589	114,794	0.38	22	0.23	1.16	0.98
IE10	0.02	0.59	0.39	29.9	99.4	32,507	48,781	107,351	0.45	46	0.30	1.29	0.98
IE11	0.02	0.59	0.39	29.9	99.4	22,577	46,915	109,278	0.43	38	0.21	1.24	0.98
IE12	0.02	0.60	0.37	30.0	99.3	18,033	42,524	112,495	0.38	21	0.16	1.13	1.00
IE13	0.02	0.59	0.39	29.9	99.3	28,071	47,716	110,016	0.43	39	0.26	1.27	0.98
IE14	0.03	0.60	0.37	29.9	99.5	25,861	46,085	106,412	0.43	39	0.24	1.22	1.00
IE15	0.02	0.60	0.38	30.0	99.3	20,225	40,728	110,295	0.37	18	0.18	1.08	1.00
IE16	0.03	0.61	0.36	29.8	98.9	17,749	42,518	89,429	0.48	52	0.20	1.13	1.02
IE17	0.03	0.61	0.36	29.8	99.2	21,197	43,448	116,894	0.37	19	0.18	1.15	1.01
IE51	0.02	0.55	0.43	30.2	99.6	14,295	41,058	99,608	0.41	32	0.14	1.09	0.92
IE52	0.02	0.55	0.43	30.0	99.4	18,054	47,621	105,186	0.45	45	0.17	1.10	0.88

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FIG. 4 Continued

IE53	0.04	0.62	0.34	29.8	99.1	16,973	37,350	125,029	0.30	-4	0.14	0.99	1.04
IE54	0.03	0.60	0.37	29.8	99.2	15,534	38,374	123,623	0.31	-1	0.13	1.02	1.00
IE55	0.03	0.61	0.36	29.9	99.3	23,550	41,444	123,673	0.34	7	0.19	1.10	1.02
IE56	0.04	0.61	0.36	29.9	99.4	16,424	42,897	118,080	0.36	16	0.14	1.14	1.01
IE18	0.03	0.61	0.35	30.0	99.3	15,077	37,433	122,201	0.31	0	0.12	0.99	1.02
IE19	0.03	0.60	0.37	30.1	99.3	24,125	44,570	111,509	0.40	29	0.22	1.18	1.00
IE20	0.03	0.63	0.34	30.0	99.0	19,125	42,664	125,366	0.34	10	0.15	1.13	1.05
IE21	0.02	0.60	0.38	30.1	99.2	23,754	44,595	115,419	0.39	25	0.21	1.18	1.00
IE22	0.02	0.60	0.39	30.1	99.0	15,129	39,009	119,378	0.33	5	0.13	1.03	1.00
IE23	0.03	0.62	0.35	30.0	99.0	14,073	39,570	128,744	0.31	-1	0.11	1.05	1.03

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FIG. 5
Table 5C. iCCD Results Showing Effects of different EEDCs on PCAT-4.

Ex.	iCCD Results												
	Wt1	Wt2	Wt3	Tp1 (°C)	Tp3 (°C)	Mw1 (g/mol)	Mw2 (g/mol)	Mw3 (g/mol)	Mw2 /Mw3	Δ(Mw2 /Mw3) (%)	Mw1 /Mw3	Mw2/ Mw2(0)	Wt2/ Wt2(0)
CE3	0.03	0.61	0.37	29.7	98.9	18,976	45,780	122,435	0.37	0	0.15	1	1
IE24	0.03	0.61	0.36	29.9	99.1	39,617	55,218	109,806	0.50	34	0.36	1.21	1.01
IE25	0.04	0.62	0.35	29.9	99.1	36,647	60,347	111,943	0.54	44	0.33	1.32	1.02
IE26	0.04	0.62	0.34	29.8	99.1	44,702	57,937	105,878	0.55	46	0.42	1.27	1.02
E27	0.05	0.63	0.32	29.6	99.0	44,703	58,893	107,614	0.55	46	0.42	1.29	1.04
IE28	0.04	0.63	0.33	29.7	99.1	48,702	63,659	106,286	0.60	60	0.46	1.39	1.04
IE29	0.04	0.63	0.34	29.8	99.1	53,756	69,520	106,312	0.65	75	0.51	1.52	1.03
IE30	0.03	0.63	0.34	29.8	99.1	53,778	71,652	108,589	0.66	76	0.50	1.57	1.03
IE31	0.03	0.61	0.37	29.7	0.0	23,350	42,162	88,827	0.47	27	0.26	0.92	1.00
IE32	0.03	0.64	0.33	29.7	98.6	26,233	59,842	104,855	0.57	53	0.25	1.31	1.05
IE33	0.02	0.62	0.35	29.6	98.8	30,495	58,470	104,602	0.56	49	0.29	1.28	1.02
CE4	0.02	0.63	0.35	29.6	98.8	25,035	56,866	113,998	0.50	33	0.22	1.24	1.03
CE5	0.02	0.60	0.39	29.8	98.8	19,851	58,715	105,287	0.56	49	0.19	1.28	0.98

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FIG. 5 Continued

CE6	0.02	0.58	0.40	29.8	98.9	17,002	56,486	107,847	0.52	40	0.16	1.23	0.95
IE34	0.01	0.52	0.47	29.8	99.2	22,543	47,065	95,674	0.49	32	0.24	1.03	0.85
IE35	0.03	0.63	0.34	29.6	98.8	28,362	54,864	105,802	0.52	39	0.27	1.20	1.03
IE36	0.03	0.61	0.36	29.8	98.9	30,396	57,201	101,793	0.56	50	0.30	1.25	1.00
IE37	0.02	0.61	0.37	29.7	99.0	29,573	57,067	112,862	0.51	35	0.26	1.25	1.00
IE38	0.02	0.59	0.39	29.7	99.0	31,899	63,229	108,685	0.58	56	0.29	1.38	0.97
IE39	0.02	0.61	0.37	29.8	98.9	26,986	61,122	108,989	0.56	50	0.25	1.34	1.00
IE40	0.02	0.59	0.38	29.8	98.9	13,293	48,421	125,693	0.39	3	0.11	1.06	0.97
IE41	0.02	0.59	0.39	29.7	98.9	11,668	53,586	130,277	0.41	10	0.09	1.17	0.97
IE42	0.01	0.55	0.43	29.8	99.1	14,390	57,316	130,054	0.44	18	0.11	1.25	0.90

FIG. 6

Table 6C. iCCD Results Showing Effects of EEDC-1 on PCAT-5.

Ex.	iCCD Results												
	Wt1	Wt2	Wt3	Tp1 (°C)	Tp3 (°C)	Mw1 (g/mol)	Mw2 (g/mol)	Mw3 (g/mol)	Mw2 /Mw3	Δ(Mw2 /Mw3) (%)	Mw1 /Mw3	Mw2/ Mw2(0)	Wt2/ Wt2(0)
CE7	0.03	0.35	0.62	30.0	99.9	24,816	69,600	198,870	0.35	0	0.12	1	1
IE43	0.02	0.37	0.61	30.0	99.9	18,091	100,341	205,831	0.49	39	0.09	1.44	1.05
IE44	0.02	0.37	0.61	30.0	99.9	23,907	108,158	208,372	0.52	48	0.11	1.55	1.04
IE45	0.02	0.37	0.61	30.1	100.0	19,376	112,003	208,802	0.54	53	0.09	1.61	1.04
IE46	0.02	0.37	0.60	30.1	100.1	19,279	117,891	206,898	0.57	63	0.09	1.69	1.04

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FIG. 7

Table 7C. iCCD Results Showing Effects of EEDC-1 on PCAT-6.

Ex.	iCCD Results													
	Wt1	Wt2	Wt3	Tp1 (°C)	Tp2 (°C)	Tp3 (°C)	Mw1 (g/mol)	Mw2 (g/mol)	Mw3 (g/mol)	Mw2 /Mw3	Δ (Mw2 /Mw3) (%)	Mw1 /Mw3	Mw2/ Mw2(0)	Wt2/ Wt2(0)
CE8	0.01	0.43	0.56	30.1	87.0	99.6	23,858	55,948	165,502	0.34	0	0.14	1	1
IE47	0.01	0.42	0.58	30.1	87.0	99.5	27,113	69,128	136,417	0.51	50	0.20	1.24	0.97
IE48	0.01	0.43	0.57	30.1	87.0	99.4	32,239	73,327	135,302	0.54	60	0.24	1.31	0.99
IE49	0.01	0.48	0.51	30.0	87.0	99.3	31,203	71,602	131,158	0.55	61	0.24	1.28	1.11
IE50	0.01	0.45	0.54	30.1	87.0	99.5	49,710	81,635	138,402	0.59	74	0.36	1.46	1.04

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FIG. 8

Table 8C. iCCD Results Showing Effects of EEDC-17 on PCAT-1.

Ex.	iCCD Results												
	Wt1	Wt2	Wt3	Tp1 (°C)	Tp3 (°C)	Mw1 (g/mol)	Mw2 (g/mol)	Mw3 (g/mol)	Mw2 /Mw3	Δ (Mw2 /Mw3) (%)	Mw1 /Mw3	Mw2/ Mw2(0)	Wt2/ Wt2(0)
CE1	0.05	0.60	0.35	29.7	99.2	13,974	41,851	122,280	0.34	0	0.11	1	1
CE9	0.02	0.52	0.46	30.0	99.2	21,310	42,036	100,015	0.42	23	0.21	0.94	0.86
CE10	0.02	0.43	0.55	30.0	99.5	15,263	43,420	102,425	0.42	24	0.15	0.98	0.72
CE11	0.02	0.42	0.57	29.9	99.6	9,457	42,669	102,232	0.42	22	0.09	0.96	0.69

FIG. 9

Table 9C. iCCD Results Showing Effects of EEDC-18 on PCAT-1.

Ex.	iCCD Results												
	Wt1	Wt2	Wt3	Tp1 (°C)	Tp3 (°C)	Mw1 (g/mol)	Mw2 (g/mol)	Mw3 (g/mol)	Mw2 /Mw3	Δ (Mw2 /Mw3) (%)	Mw1/ Mw3	Mw2/ Mw2(0)	Wt2/ Wt2(0)
CE1	0.05	0.60	0.35	29.7	99.2	13,974	41,851	122,280	0.34	0	0.11	1	1
CE12	0.01	0.38	0.61	29.9	99.8	22,471	43,425	106,600	0.41	19	0.21	0.92	0.63
CE13	0.01	0.38	0.61	29.9	99.8	14,439	47,787	109,060	0.44	28	0.13	1.01	0.63
CE14	0.02	0.36	0.62	29.9	100.0	13,651	51,343	110,561	0.46	36	0.12	1.09	0.60

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FIG. 10

Table 10. LLDPE Polymer Properties Showing Effects of EEDC-1 on PCAT-1 or PCAT-4.

Example	TEA/Ti (Mol/ Mol)	EEDC/Ti (Mol/ Mol)	I ₂ (g/10 min)	I ₂₁ /I ₂	$\Delta(I_{21}$ /I ₂)	Mw (g/mol)	Mw/ Mn	Mz/ Mw	$\Delta(Mz/Mw)$ (%)	CDI	$\Delta(CDI)$ (%)	Hexane Extract. Content (%)	Δ (Hexane Extractable Content) (%)
CE-P1	60.0	0	1.1	29.8	0	124,627	5.10	3.88	0	-2.19	0	1.5	0
IE-P1	60.3	2.96	1.0	25.2	-4.6	122,795	4.07	3.07	-21	-1.62	26	0.78	-48
CE-P6	53	0	1.0	29.4	0	130,460	5.06	3.33	0	-1.66	0	1.21	0
IE-P4	86	22.0	1.0	24.4	-5.0	141,452	5.49	4.08	23	-0.92	44	0.67	-33
CE-P7	159	0	0.94	31.7	0	126,201	4.59	2.91	0	-2.21	0	1.45	0
IE-P5	222	26.9	1.0	24.6	-7.1	125,750	4.49	2.78	-5	-1.17	47	0.81	-19

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FIG. 11

Table 11. HDPE Polymer Properties Showing Effects of different EEDCs on PCAT-1 or PCAT-4.

Ex.	TEA/Ti (Mol/ Mol)	EEDC/Ti (Mol/ Mol)	Resin Density (g/cc)	I ₂ (g/10 min)	I ₂₁ /I ₂	$\Delta(I_{21}/I_2)$	Mw (g/mol)	Mw/ Mn	Mz/ Mw	$\Delta(Mz/Mw)$ (%)	CDI	$\Delta(CDI)$ (%)
CE-P2	38.8	0	0.9488	3.7	24.3	0	92,081	4.56	4.20	0	-0.30	0
IE-P2	49.4	2.17	0.9486	3.6	22.9	-1.4	87,807	4.22	3.24	-26	-0.30	0
CE-P3	51.8	3.24	0.9489	3.6	21.4	-2.8	84,840	3.91	2.94	-35	-0.40	-35
CE-P4	36.7	0	0.9524	9.6	24.1	0	70,644	4.52	4.22	0	-0.39	0
IE-P3	44.5	2.20	0.9523	9.3	22.2	-1.9	66,544	4.13	3.05	-32	-0.33	14
CE-P5	51.8	3.49	0.9522	10.1	22.6	-1.5	65,130	3.86	2.79	-39	-0.54	-39
CE-P8	191	0	0.9520	10.3	25.8	0	71,169	4.56	4.17	0	-0.22	0
IE-P6	187	22.6	0.9515	10.1	21.7	-4.1	67,994	3.98	3.06	-37	-0.30	-36