

Extremely uniform dispersion of MWCNTs in olefin block copolymer significantly enhances electrical and mechanical performance

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Electronic supplementary information

Table S1 Sample informations of ORC^a and OBC^b.

Properties	Density (g.cm ⁻³)	Mw (g.mol ⁻¹)	Mw/Mn	Tg (°C)
ORC 8150	0.868	162,700	2.1	-42.9
OBC 9500	0.878	82, 600	2.3	-45

a. provided by Bartczak et al.¹ and Mäder et al.².

b. provided by Wu et al.³.

It is worth mentioning that the use of surface energies of ORCs in previous researches is relatively arbitrary without considering the octene content. For instance, the octene content of Engage 8130 and Engage 8200 is 42 wt.%^{4,5} and 24 wt.%^{6,7}, respectively. Engage 8130 was utilized by M. Bailly et al.⁸ while surface energies of Engage 8200 were considered during the calculation in their work. This may be because although the octene content in ORCs is different, the surface energies of the copolymers are close enough. To prove this point, surface energies of ORCs with different octene content were calculated by Synthia module of Material Studio. Nevertheless, the results octane shows the content of octane has little effect on the surface energies of ORCs. Therefore, it is reasonable to use the surface energies of ORC with 39 wt.% octene content to describe the ethylene- α -octene-rich domains of ORC and OBC during our calculation.

Table S2 Surface tensions of random ethylene-octene copolymers of different octane content.

Monomer 1	wt.% 1	Monomer 2	wt.% 2	T (K)	Molecular weight	Surface tension (molar parachor) (Synthia)	Surface tension (Fedors) at 298K (Synthia)	Surface tension (van Krevelen) at 298K (Synthia)
octane	0.01	ethylene	0.99	463	1.63E+05	20.17139	34.16169	32.27214
octane	0.02	ethylene	0.98	463	1.63E+05	20.17733	34.17056	32.28339
octane	0.03	ethylene	0.97	463	1.63E+05	20.18328	34.17943	32.29466
octane	0.04	ethylene	0.96	463	1.63E+05	20.18924	34.18831	32.30592

octane	0.05	ethylene	0.95	463	1.63E+05	20.1952	34.1972	32.3172
octane	0.06	ethylene	0.94	463	1.63E+05	20.20117	34.20609	32.32848
octane	0.07	ethylene	0.93	463	1.63E+05	20.20715	34.21498	32.33977
octane	0.08	ethylene	0.92	463	1.63E+05	20.21313	34.22388	32.35106
octane	0.09	ethylene	0.91	463	1.63E+05	20.21912	34.23279	32.36237
octane	0.1	ethylene	0.9	463	1.63E+05	20.22512	34.2417	32.37367
octane	0.11	ethylene	0.89	463	1.63E+05	20.23112	34.25062	32.38499
octane	0.12	ethylene	0.88	463	1.63E+05	20.23713	34.25955	32.39631
octane	0.13	ethylene	0.87	463	1.63E+05	20.24315	34.26848	32.40764
octane	0.14	ethylene	0.86	463	1.63E+05	20.24918	34.27741	32.41897
octane	0.15	ethylene	0.85	463	1.63E+05	20.25521	34.28635	32.43031
octane	0.16	ethylene	0.84	463	1.63E+05	20.26124	34.2953	32.44166
octane	0.17	ethylene	0.83	463	1.63E+05	20.26729	34.30425	32.45302
octane	0.18	ethylene	0.82	463	1.63E+05	20.27334	34.31321	32.46438
octane	0.19	ethylene	0.81	463	1.63E+05	20.2794	34.32217	32.47575
octane	0.2	ethylene	0.8	463	1.63E+05	20.28546	34.33114	32.48712
octane	0.21	ethylene	0.79	463	1.63E+05	20.29154	34.34012	32.4985
octane	0.22	ethylene	0.78	463	1.63E+05	20.29761	34.3491	32.50989
octane	0.23	ethylene	0.77	463	1.63E+05	20.3037	34.35809	32.52129
octane	0.24	ethylene	0.76	463	1.63E+05	20.30979	34.36708	32.53269
octane	0.25	ethylene	0.75	463	1.63E+05	20.31589	34.37608	32.5441
octane	0.26	ethylene	0.74	463	1.63E+05	20.322	34.38508	32.55551
octane	0.27	ethylene	0.73	463	1.63E+05	20.32811	34.39409	32.56693
octane	0.28	ethylene	0.72	463	1.63E+05	20.33423	34.40311	32.57836
octane	0.29	ethylene	0.71	463	1.63E+05	20.34035	34.41213	32.5898
octane	0.3	ethylene	0.7	463	1.63E+05	20.34648	34.42115	32.60124
octane	0.31	ethylene	0.69	463	1.63E+05	20.35262	34.43019	32.61269
octane	0.32	ethylene	0.68	463	1.63E+05	20.35877	34.43922	32.62415
octane	0.33	ethylene	0.67	463	1.63E+05	20.36492	34.44827	32.63561
octane	0.34	ethylene	0.66	463	1.63E+05	20.37108	34.45732	32.64708
octane	0.35	ethylene	0.65	463	1.63E+05	20.37724	34.46637	32.65855
octane	0.36	ethylene	0.64	463	1.63E+05	20.38342	34.47543	32.67004
octane	0.37	ethylene	0.63	463	1.63E+05	20.3896	34.4845	32.68153
octane	0.38	ethylene	0.62	463	1.63E+05	20.39578	34.49357	32.69302
octane	0.39	ethylene	0.61	463	1.63E+05	20.40197	34.50265	32.70453
octane	0.4	ethylene	0.6	463	1.63E+05	20.40817	34.51174	32.71604
octane	0.41	ethylene	0.59	463	1.63E+05	20.41437	34.52083	32.72756
octane	0.42	ethylene	0.58	463	1.63E+05	20.42058	34.52992	32.73908
octane	0.43	ethylene	0.57	463	1.63E+05	20.4268	34.53903	32.75061
octane	0.44	ethylene	0.56	463	1.63E+05	20.43303	34.54813	32.76215
octane	0.45	ethylene	0.55	463	1.63E+05	20.43926	34.55725	32.77369
octane	0.46	ethylene	0.54	463	1.63E+05	20.44549	34.56637	32.78525
octane	0.47	ethylene	0.53	463	1.63E+05	20.45173	34.57549	32.7968
octane	0.48	ethylene	0.52	463	1.63E+05	20.45798	34.58462	32.80837

octane	0.49	ethylene	0.51	463	1.63E+05	20.46424	34.59376	32.81994
octane	0.5	ethylene	0.5	463	1.63E+05	20.4705	34.6029	32.83152
octane	0.51	ethylene	0.49	463	1.63E+05	20.47677	34.61205	32.84311
octane	0.52	ethylene	0.48	463	1.63E+05	20.48304	34.62121	32.8547
octane	0.53	ethylene	0.47	463	1.63E+05	20.48932	34.63037	32.8663
octane	0.54	ethylene	0.46	463	1.63E+05	20.4956	34.63953	32.87791
octane	0.55	ethylene	0.45	463	1.63E+05	20.50189	34.6487	32.88952
octane	0.56	ethylene	0.44	463	1.63E+05	20.50819	34.65788	32.90114
octane	0.57	ethylene	0.43	463	1.63E+05	20.51449	34.66707	32.91277
octane	0.58	ethylene	0.42	463	1.63E+05	20.5208	34.67626	32.92441
octane	0.59	ethylene	0.41	463	1.63E+05	20.52712	34.68545	32.93605
octane	0.6	ethylene	0.4	463	1.63E+05	20.53343	34.69465	32.9477
octane	0.61	ethylene	0.39	463	1.63E+05	20.53976	34.70386	32.95935
octane	0.62	ethylene	0.38	463	1.63E+05	20.54609	34.71308	32.97101
octane	0.63	ethylene	0.37	463	1.63E+05	20.55242	34.7223	32.98268
octane	0.64	ethylene	0.36	463	1.63E+05	20.55876	34.73152	32.99436
octane	0.65	ethylene	0.35	463	1.63E+05	20.56511	34.74075	33.00605
octane	0.66	ethylene	0.34	463	1.63E+05	20.57146	34.74999	33.01774
octane	0.67	ethylene	0.33	463	1.63E+05	20.57782	34.75923	33.02943
octane	0.68	ethylene	0.32	463	1.63E+05	20.58418	34.76848	33.04114
octane	0.69	ethylene	0.31	463	1.63E+05	20.59054	34.77774	33.05285
octane	0.7	ethylene	0.3	463	1.63E+05	20.59691	34.787	33.06457
octane	0.71	ethylene	0.29	463	1.63E+05	20.60328	34.79627	33.0763
octane	0.72	ethylene	0.28	463	1.63E+05	20.60966	34.80554	33.08803
octane	0.73	ethylene	0.27	463	1.63E+05	20.61604	34.81482	33.09977
octane	0.74	ethylene	0.26	463	1.63E+05	20.62242	34.82411	33.11152
octane	0.75	ethylene	0.25	463	1.63E+05	20.62881	34.8334	33.12327
octane	0.76	ethylene	0.24	463	1.63E+05	20.6352	34.84269	33.13503
octane	0.77	ethylene	0.23	463	1.63E+05	20.6416	34.852	33.1468
octane	0.78	ethylene	0.22	463	1.63E+05	20.64799	34.86131	33.15858
octane	0.79	ethylene	0.21	463	1.63E+05	20.65439	34.87062	33.17036
octane	0.8	ethylene	0.2	463	1.63E+05	20.66079	34.87994	33.18215
octane	0.81	ethylene	0.19	463	1.63E+05	20.6672	34.88927	33.19395
octane	0.82	ethylene	0.18	463	1.63E+05	20.6736	34.89861	33.20575
octane	0.83	ethylene	0.17	463	1.63E+05	20.68001	34.90795	33.21756
octane	0.84	ethylene	0.16	463	1.63E+05	20.68641	34.91729	33.22938
octane	0.85	ethylene	0.15	463	1.63E+05	20.69282	34.92664	33.24121
octane	0.86	ethylene	0.14	463	1.63E+05	20.69923	34.936	33.25304
octane	0.87	ethylene	0.13	463	1.63E+05	20.70563	34.94537	33.26488
octane	0.88	ethylene	0.12	463	1.63E+05	20.71204	34.95474	33.27673
octane	0.89	ethylene	0.11	463	1.63E+05	20.71844	34.96411	33.28858
octane	0.9	ethylene	0.1	463	1.63E+05	20.72484	34.97349	33.30045
octane	0.91	ethylene	0.09	463	1.63E+05	20.73123	34.98288	33.31232
octane	0.92	ethylene	0.08	463	1.63E+05	20.73763	34.99228	33.32419

octane	0.93	ethylene	0.07	463	1.63E+05	20.74401	35.00168	33.33608
octane	0.94	ethylene	0.06	463	1.63E+05	20.75039	35.01109	33.34797
octane	0.95	ethylene	0.05	463	1.63E+05	20.75677	35.0205	33.35986
octane	0.96	ethylene	0.04	463	1.63E+05	20.76313	35.02992	33.37177
octane	0.97	ethylene	0.03	463	1.63E+05	20.76949	35.03934	33.38368
octane	0.98	ethylene	0.02	463	1.63E+05	20.77583	35.04877	33.3956
octane	0.99	ethylene	0.01	463	1.63E+05	20.78216	35.05821	33.40753

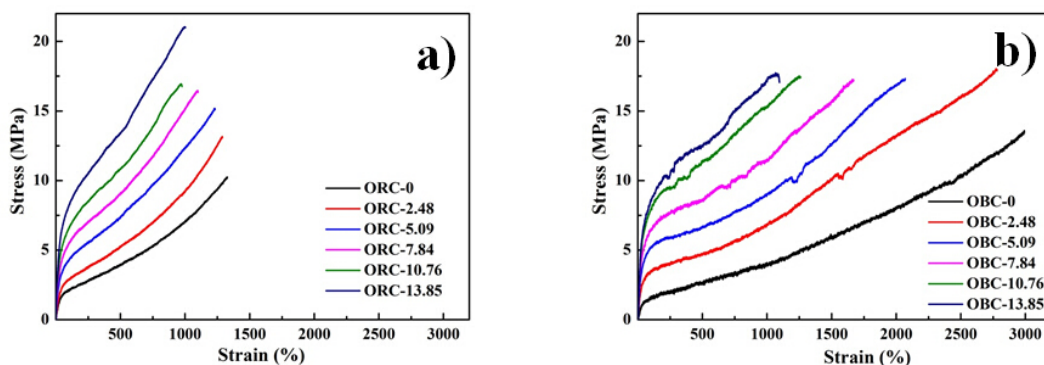


Fig. S1 The representative uniaxial tensile stress-strain curves of (a) ORC composites, (b) OBC composites.

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