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Facile preparation route for graphene oxide reinforced polyamide 6 composites via in situ anionic ring-opening polymerization

(Supporting Information)

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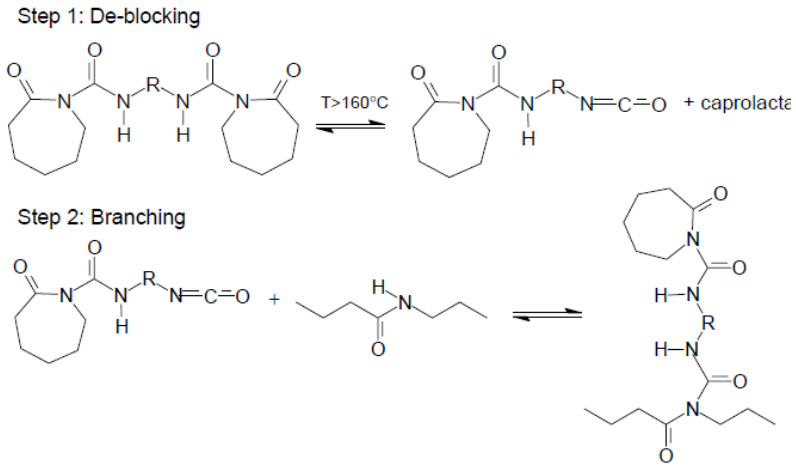

Figure S1 Reaction scheme for branching that take place during anionic polymerization of caprolactam when using a difunctional blocked isocyanate activator.[Polym Test 2005;25:392-404]

Differential scanning calorimetry procedures

The non-isothermal analyses were carried out using a Perkin Elmer DSC-7 differential scanning calorimeter thermal analyzer. About 10 mg of the polymer sample was weighted very accurately in the aluminium differential scanning calorimetry (DSC) pan and placed in the DSC cell. It was heated from 25 ^{o}C to 250 ^{o}C at a rate of 30 ^{o}C/min under nitrogen atmosphere. The sample was kept for 2 min at

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this temperature to eliminate the heat history before cooling at a specified cooling rate. Constant cooling rate10, 15, 20, 25 and30 ^{o}C/min were applied. The thermograms corresponding to the heating and cooling cycles were recorded and analyzed to estimate the non-isothermal crystallization kinetics and crystallinity degree.

The Non-isothermal crystallization kinetics model is according to the literature [European Polymer Journal 2002, 38, 1383-1389; Thermochimica Acta 2010, 500, 13–20].

Table S1 Value of T_o, T_c , ΔH, n, Z_t and $t_{1/2}$ at various cooling rates for PA6 and PA6-GO nanocomposite

Cooling rate (^{o}C/min)	Onset T_o (^{o}C)	End T (^{o}C)	T_c (^{o}C)	ΔH （J/g）	n	Z_t	$t_{1/2}$ (min)
PA6							
10	173.5	162.7	168.2	46.63	3.57	1.07	0.886
15	168.6	156.7	162.7	43.11	3.70	2.91	0.679
20	165.8	152.7	159.2	42.23	3.67	6.20	0.551
25	163.8	149.6	156.8	41.80	3.59	11.63	0.456
30	162.0	147.0	154.6	39.91	3.02	17.97	0.340
PA-GO-0.05							
10	178.0	166.7	173.4	47.47	2.81	0.96	0.891
15	175.6	164.2	170.91	47.35	3.27	2.61	0.666
20	173.7	161.9	168.79	47.07	3.63	4.79	0.587
25	172.0	160.0	167.18	47.18	3.56	9.10	0.486
30	170.6	158.4	165.56	45.53	3.55	17.27	0.404
PA-GO-0.2							
10	185.16	173.7	180.3	51.00	3.02	0.87	0.927
15	182.27	170.3	177.1	49.71	3.15	2.41	0.673
20	180.12	167.7	174.7	49.46	3.50	4.91	0.571
25	178.39	165.4	172.9	49.25	3.57	8.80	0.491
30	177.23	163.6	171.5	49.96	3.43	15.34	0.405
PA-GO-1.0							
10	184.17	170.8	178.4	51.11	3.12	0.68	1.005
15	180.90	166.7	174.9	49.27	3.13	1.85	0.731
20	178.65	163.6	172.1	49.00	3.39	3.41	0.625
25	176.94	161.2	170.1	47.88	3.20	6.22	0.504
30	175.74	159.6	169.1	45.36	3.23	9.85	0.441

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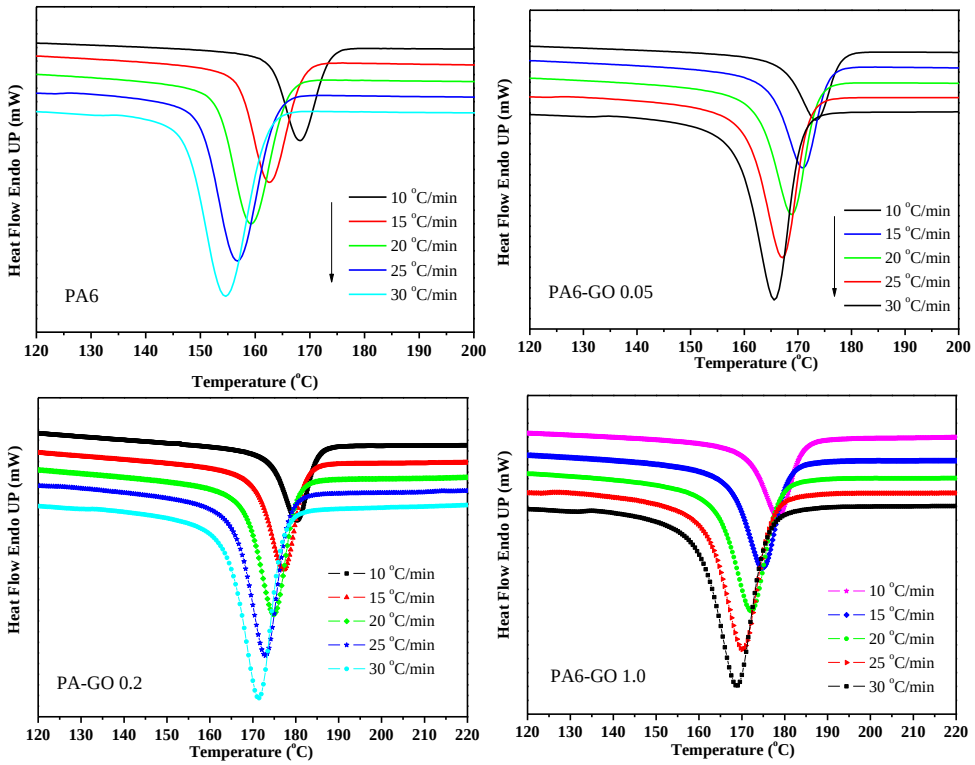

Figure S2. DSC thermograms of non-isothermal crystallization at different cooling rates for PA6 and PA6-GO nano composite with different g-GO loadings.

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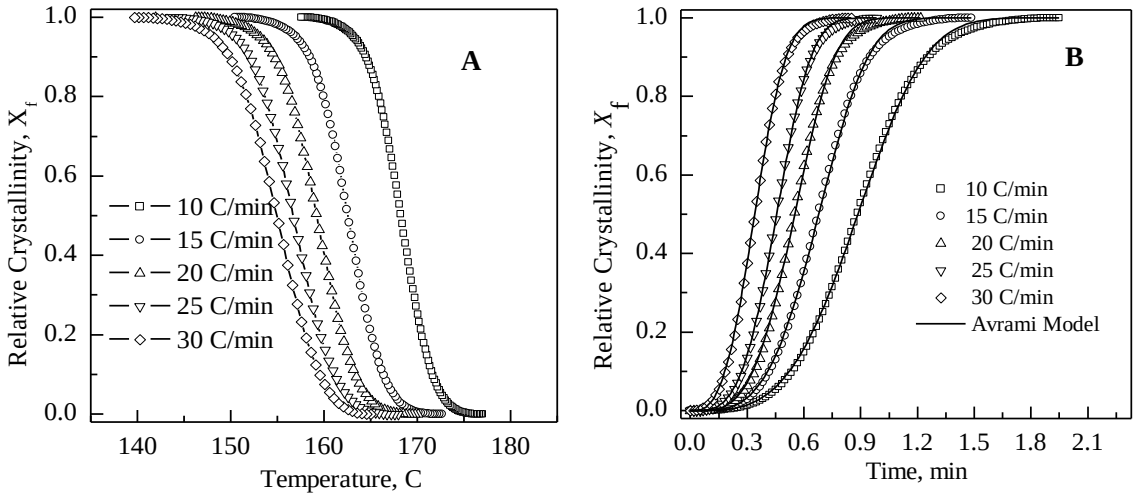

Figure S3. Polt of relative crystallinity as a function of temperature (A) and time(B) for neat PA6 crystallized non-isothermally at various cooling.

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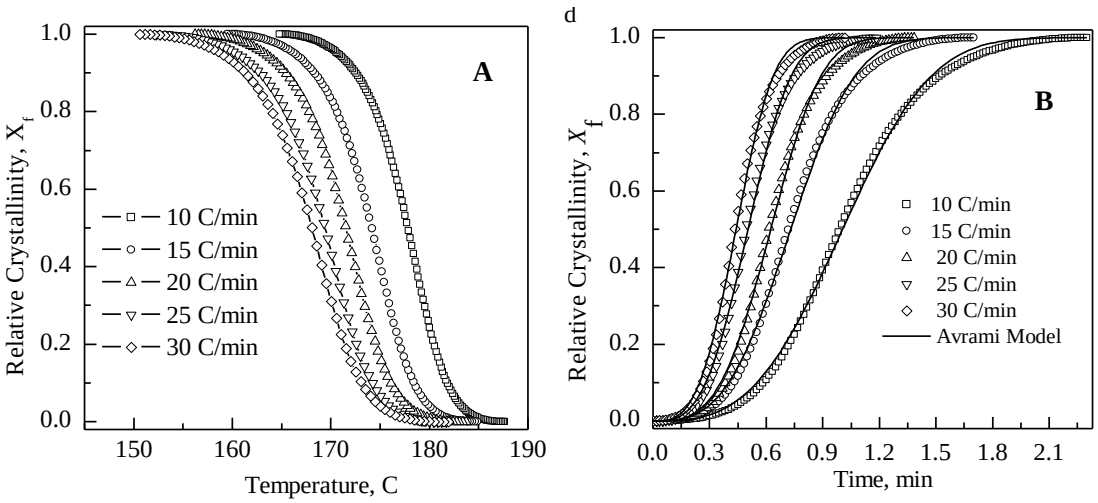

Figure S4 Polt of relative crystallinity as a function of temperature (A) and time (B) for neat PA6 crystallized non-isothermally at various cooling.

Table S2. X-ray diffraction parameters of neat PA6 and PA6-GO nanocomposites

Sample	$2\theta_1$	$2\theta_2$	I_1	I_2	I_1/I_2
PA6	20.0°	23.9	352	239	1.47
PA6-GO-0.01	19.9	23.7	93	250	0.37
PA6-GO-0.05	20.3	24.1	118.7	264	0.45
PA6-GO-0.1	20.3	24.0	171	295	0.58
PA6-GO-0.2	20.3	24.1	164	351	0.46
PA6-GO-0.5	20.3	24.0	120	240	0.51
PA6-GO-1.0	20.2	23.9	154	232	0.52