

1/20

FIG. 1

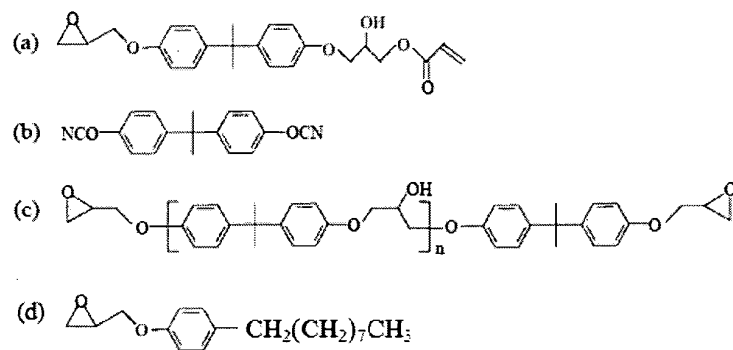
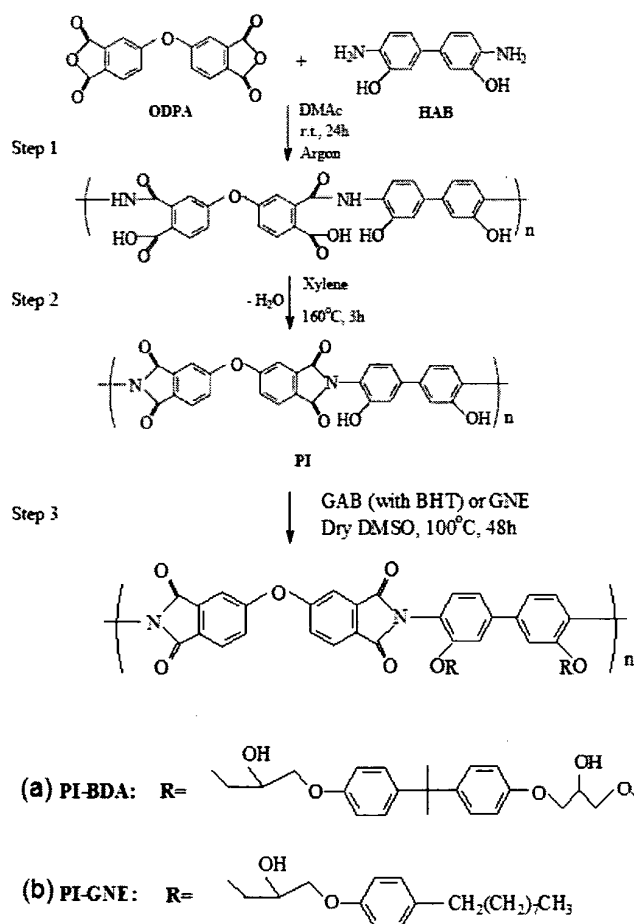


FIG. 2



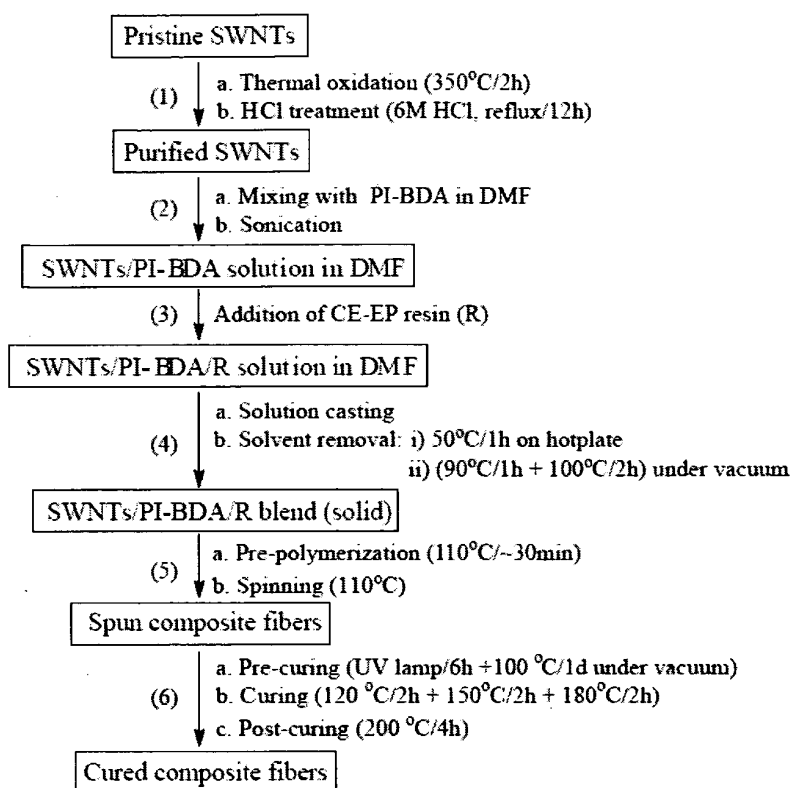
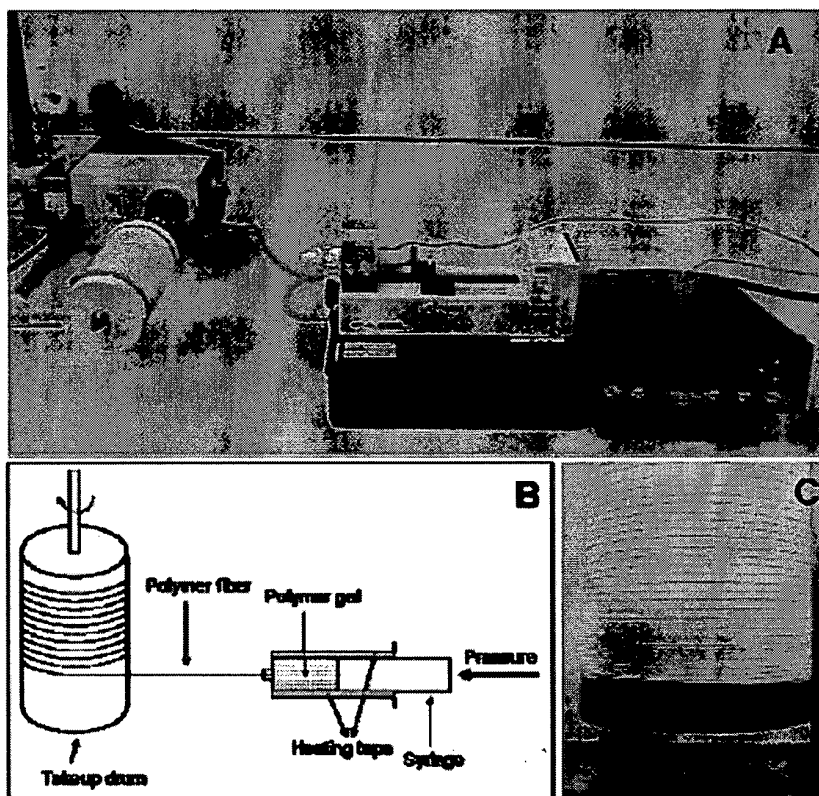
2/20
FIG. 3

FIG. 4



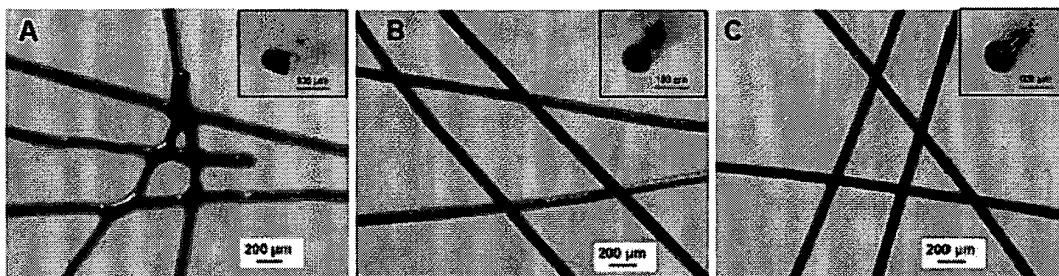
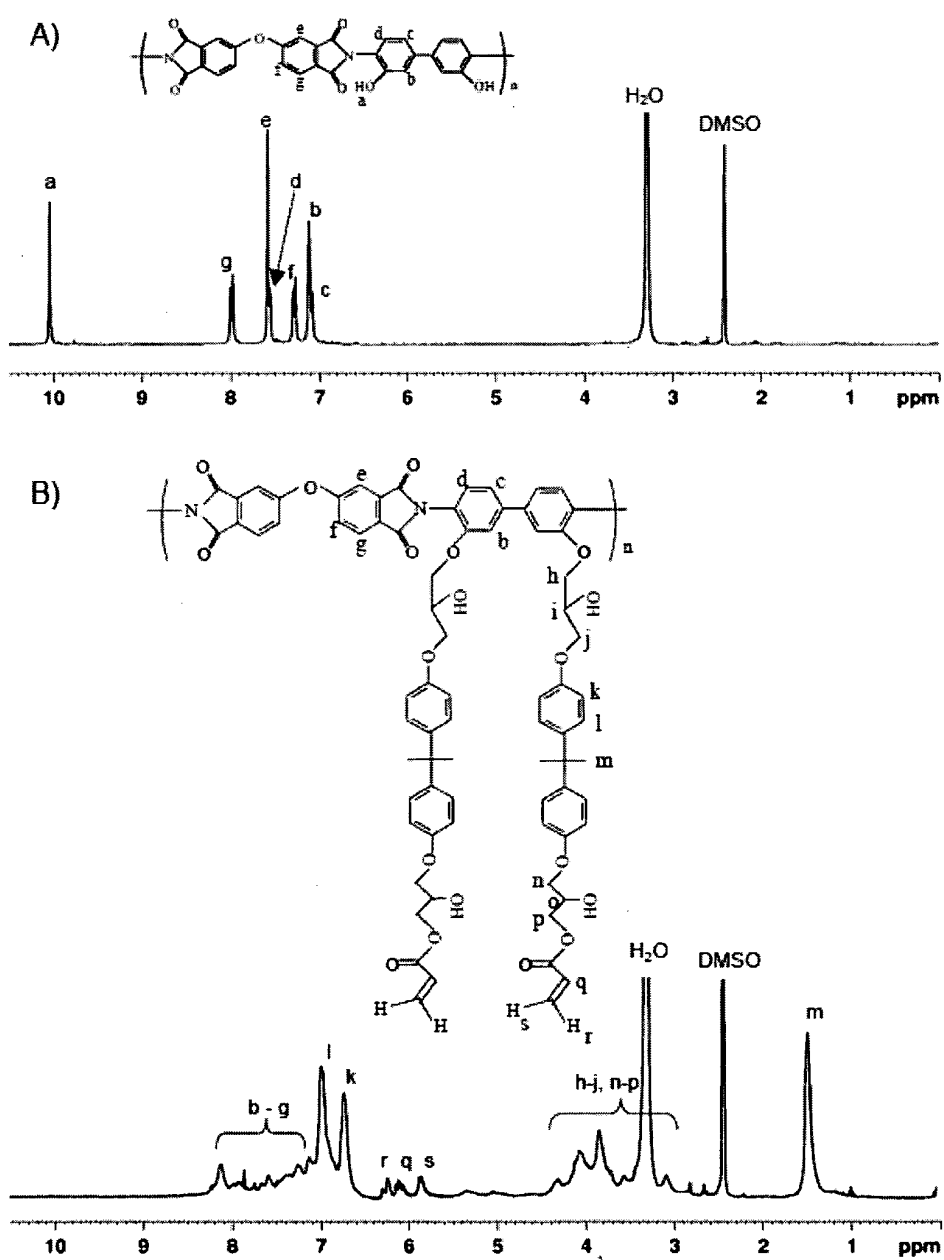
3/20
FIG. 5

FIG. 6



4/20
FIG. 7

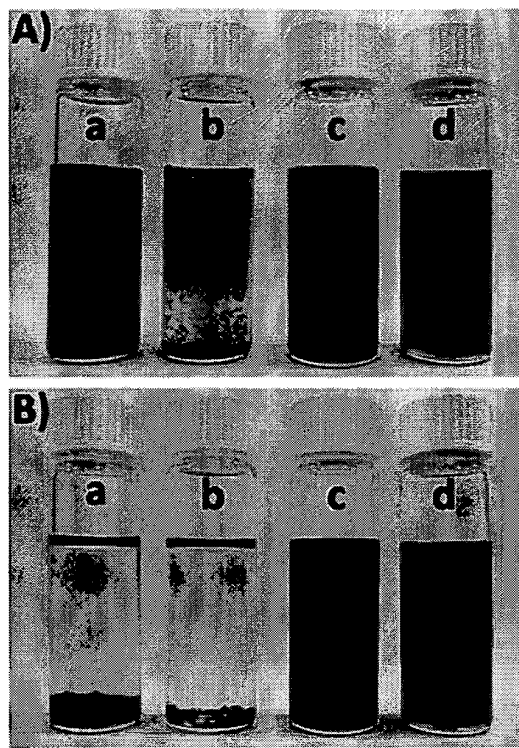
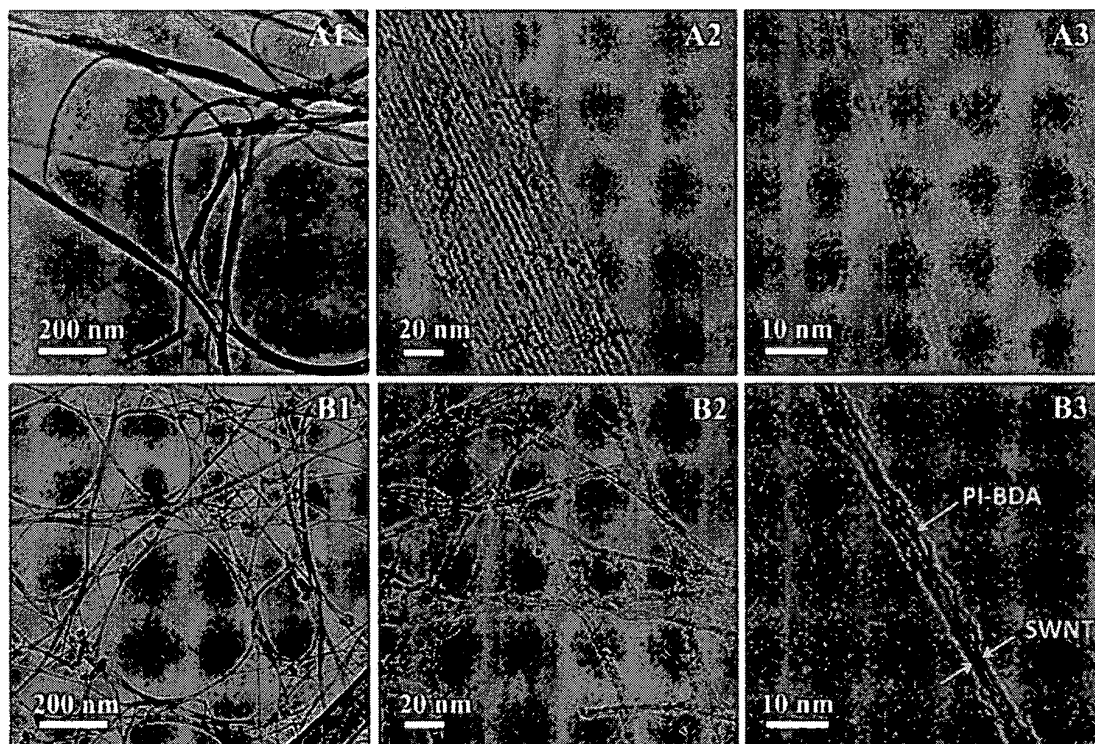


FIG. 8



5/20

FIG. 9

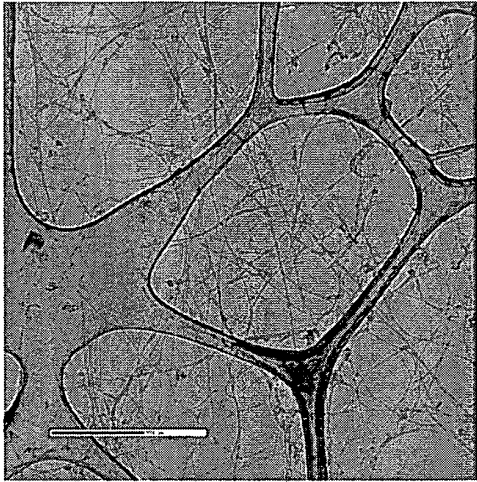


FIG. 10

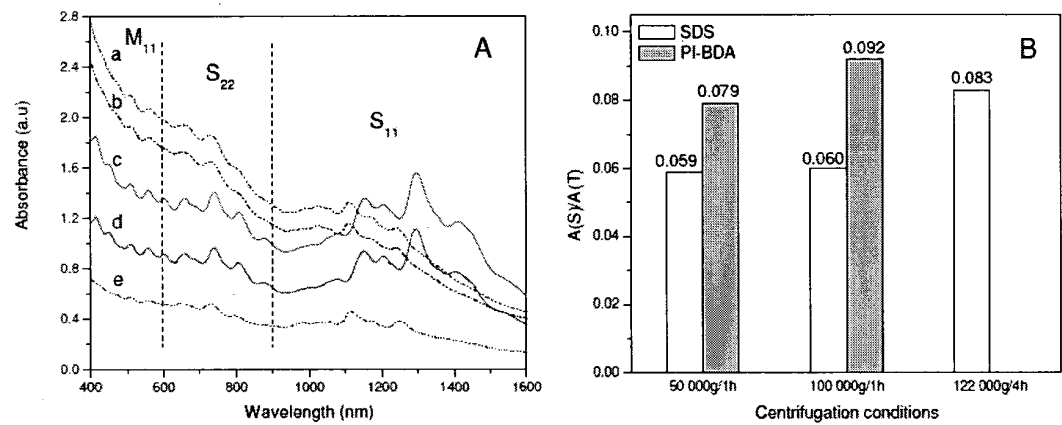
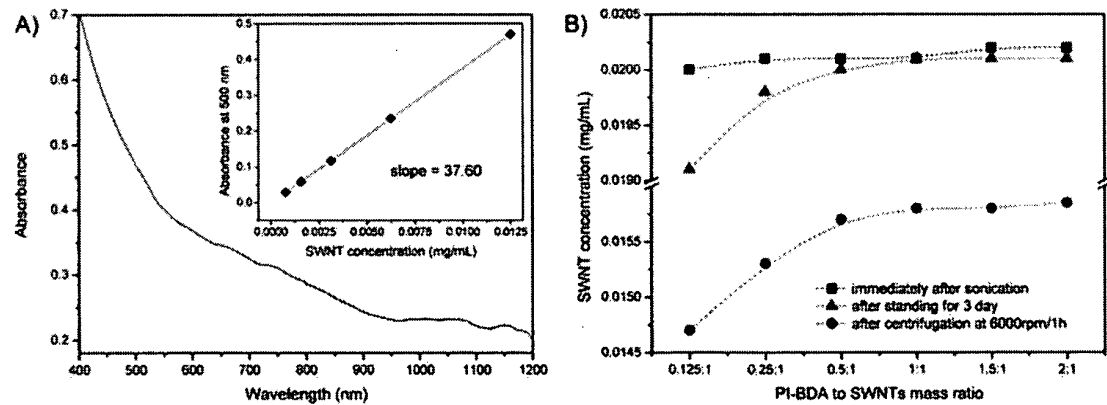


FIG. 11



6/20
FIG. 12

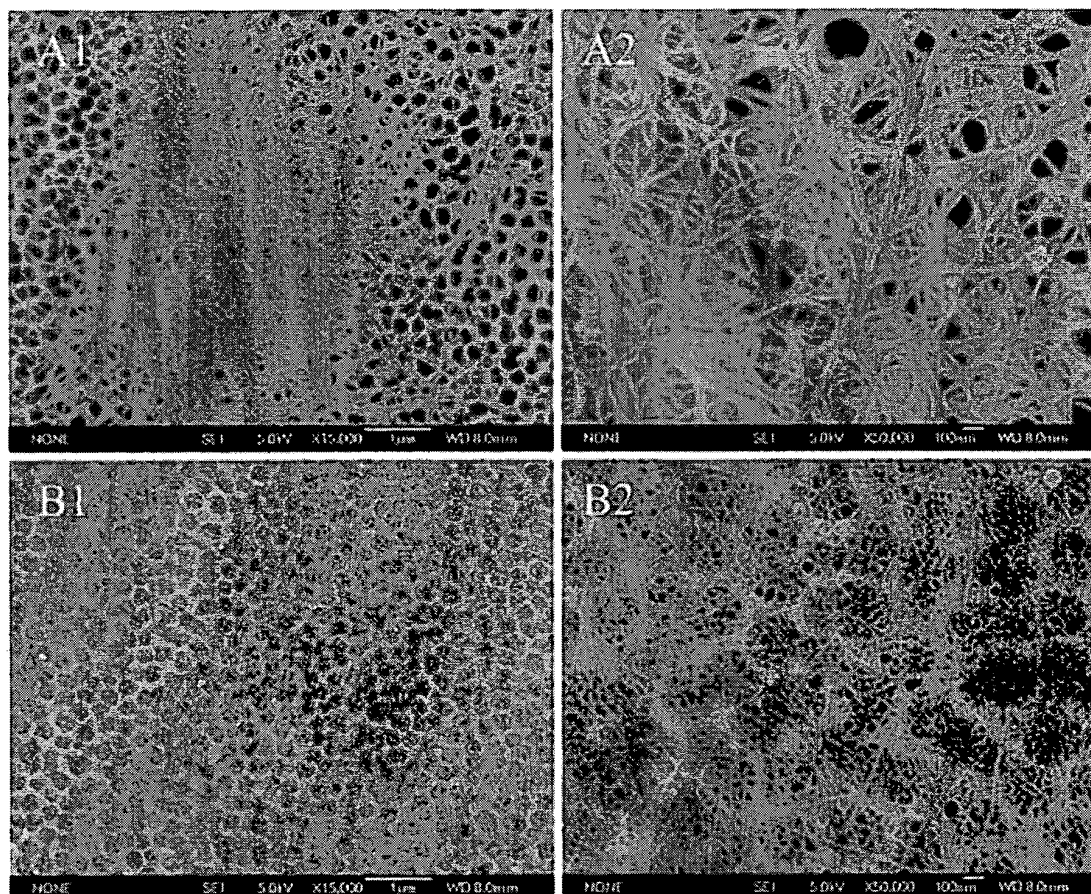
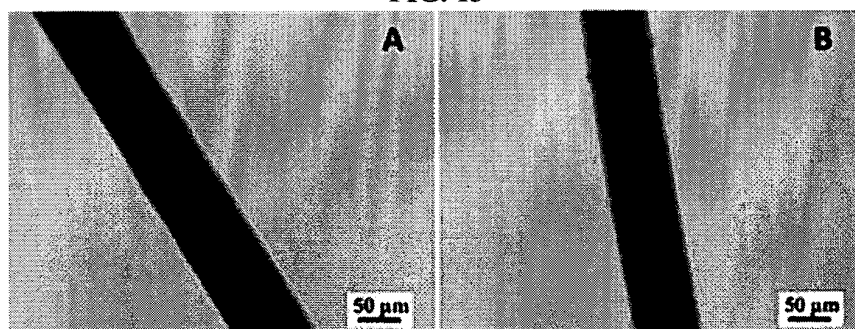
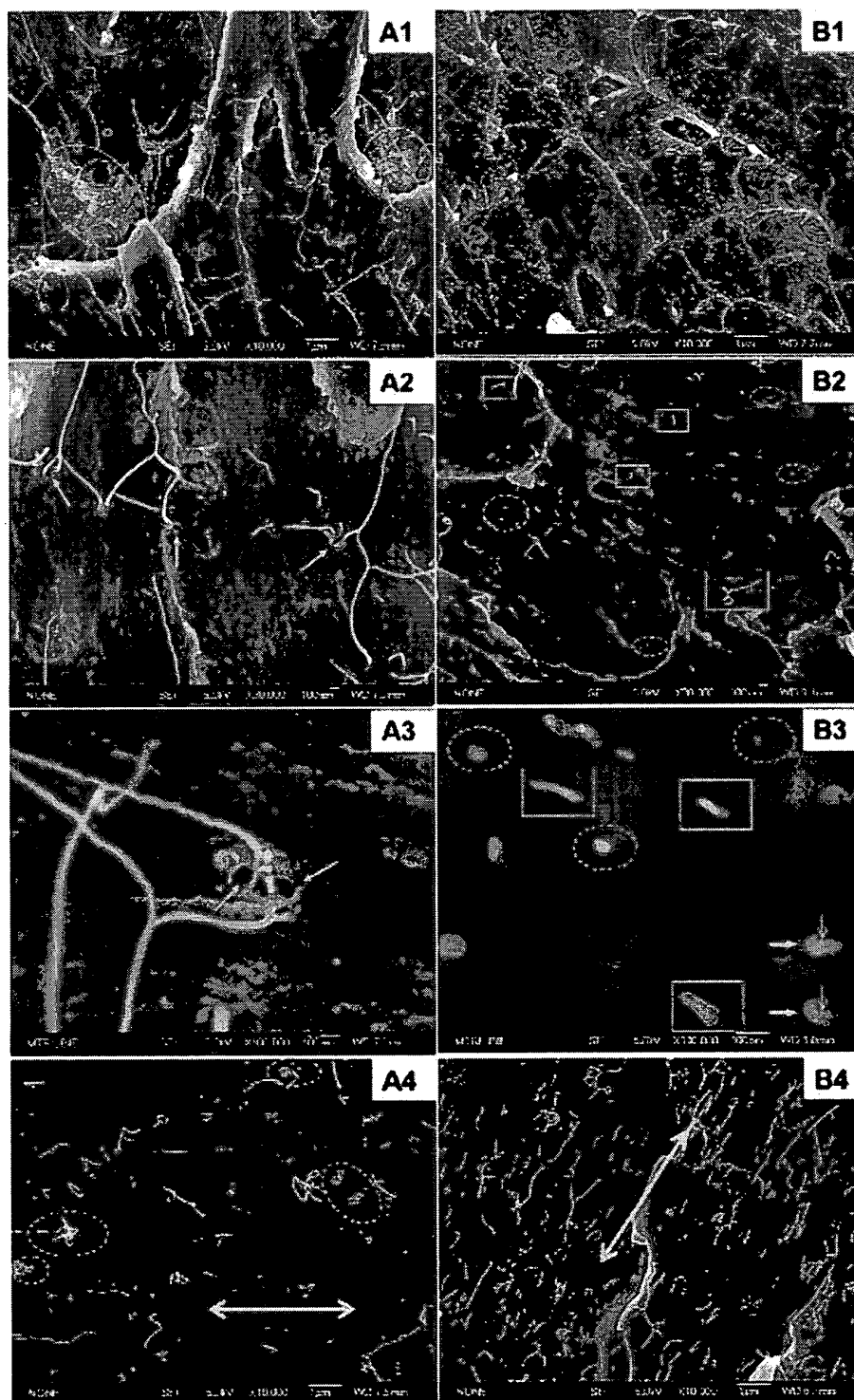


FIG. 13



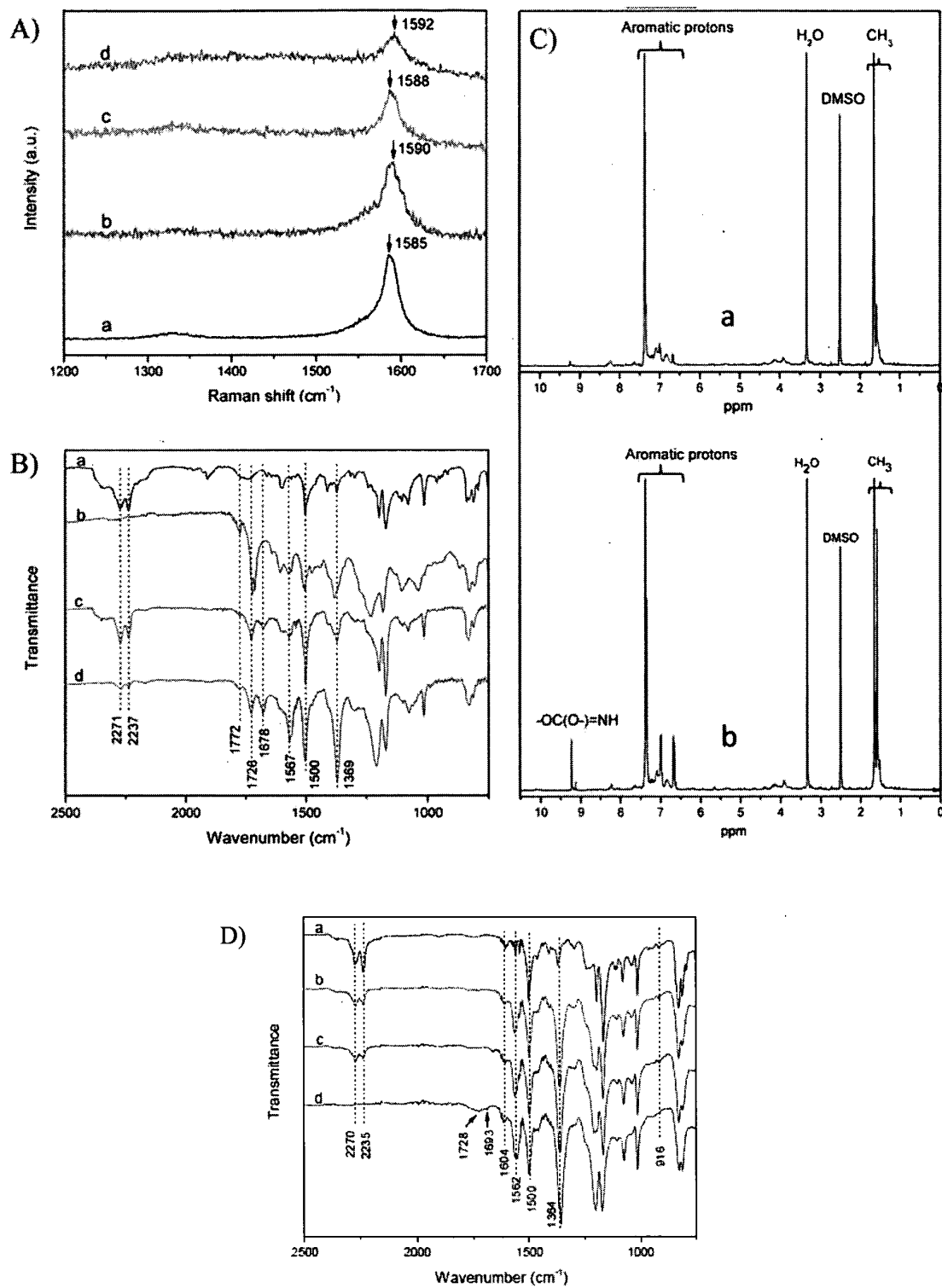
7/20

FIG. 14



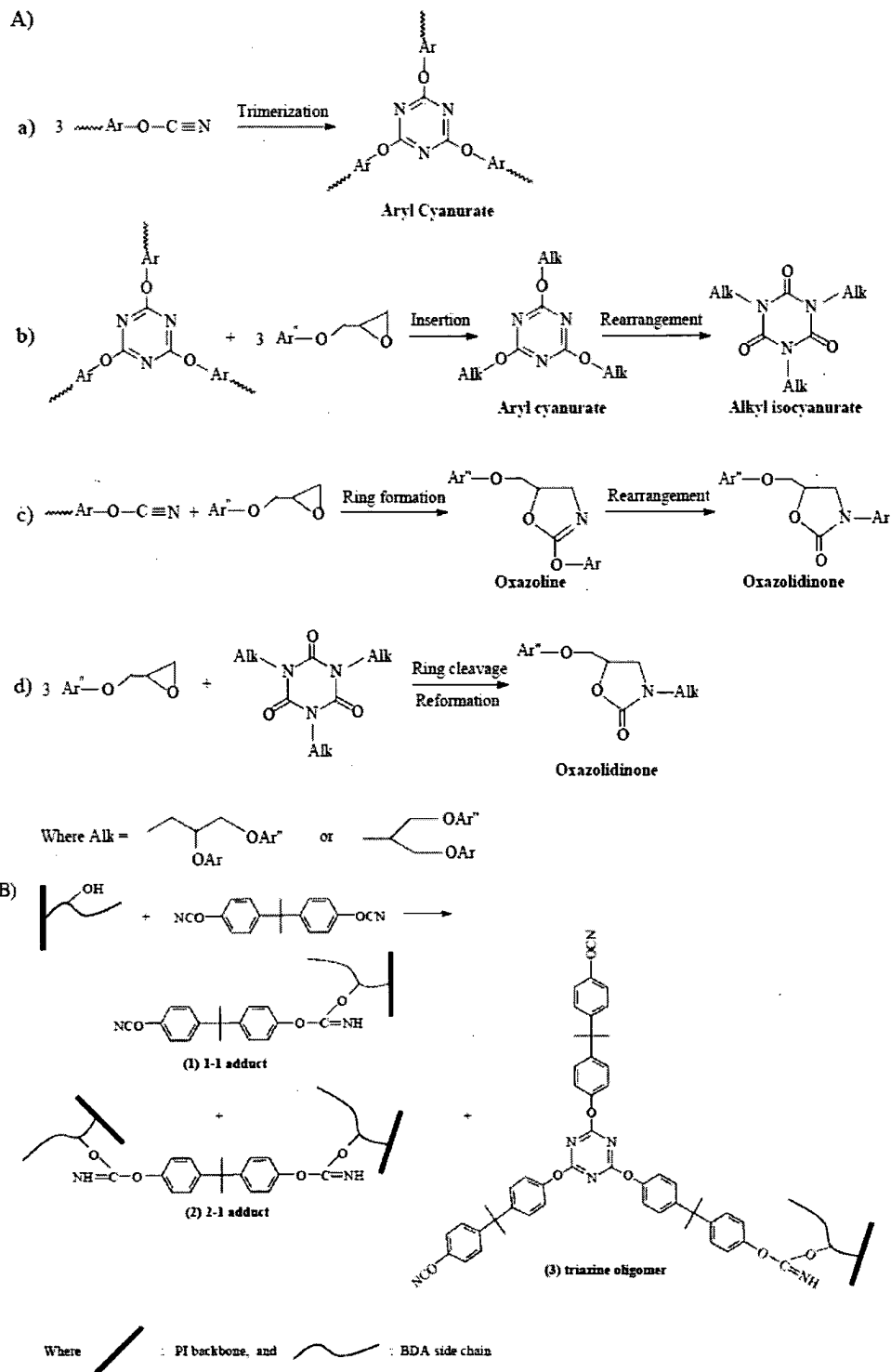
8/20

FIG. 15



9/20

FIG. 16

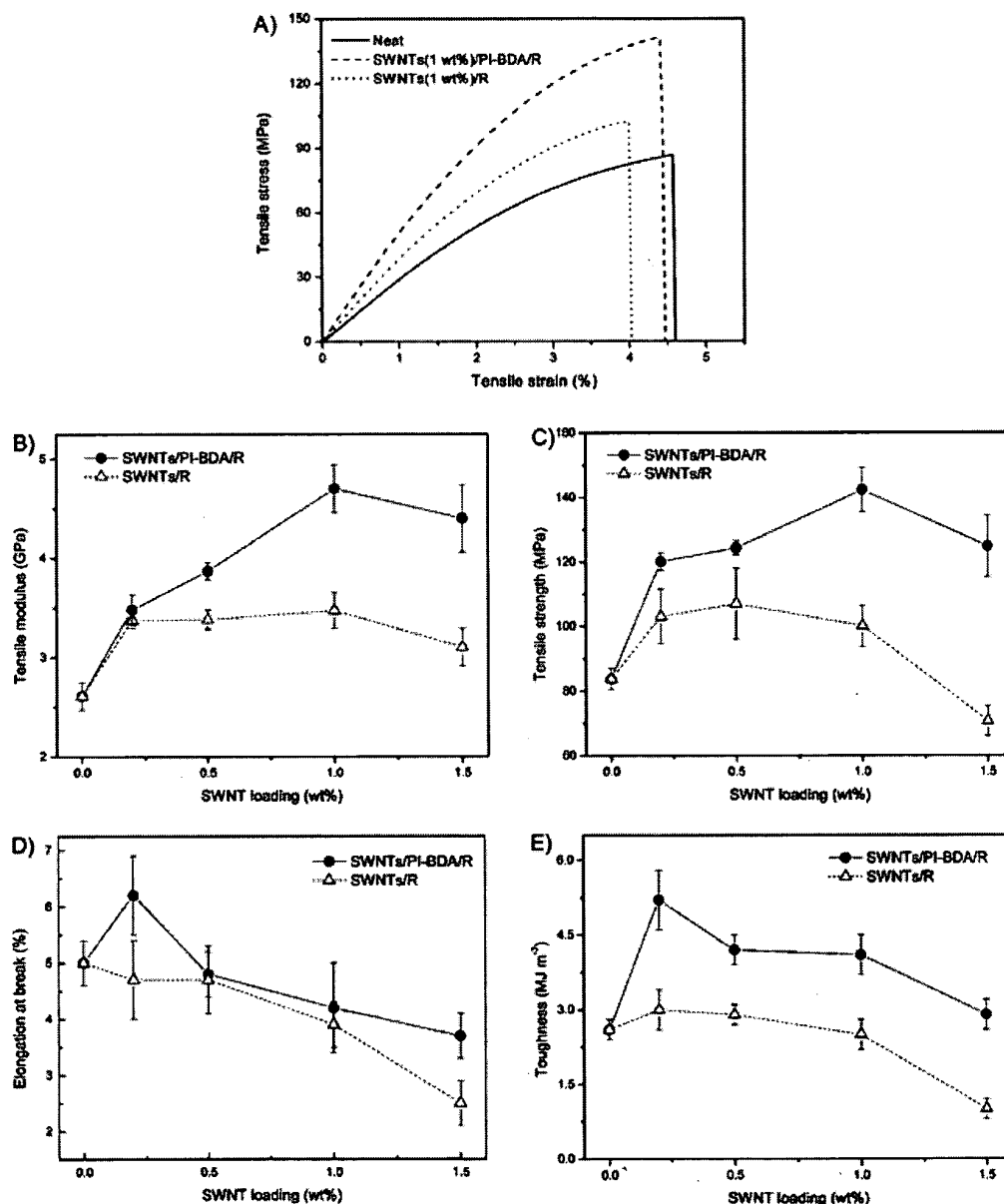


10/20
FIG. 17

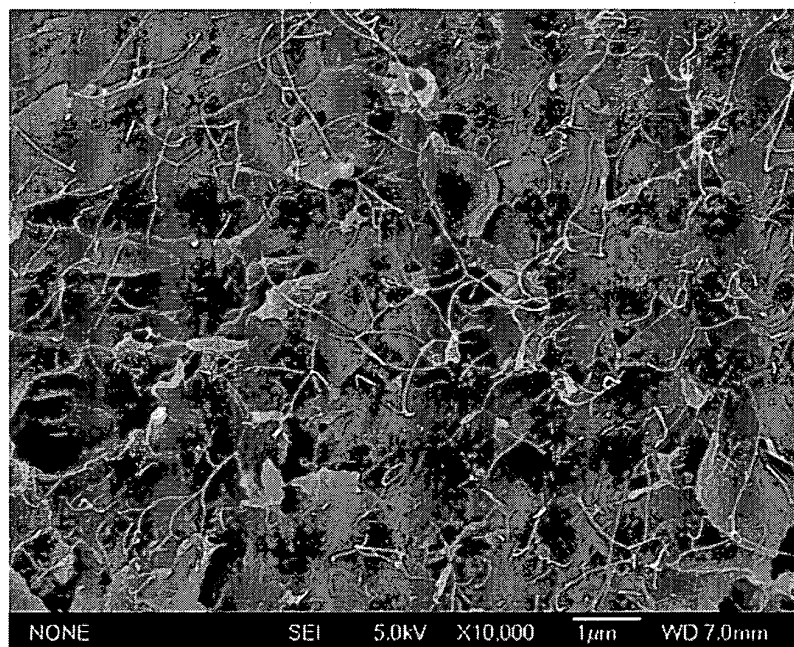
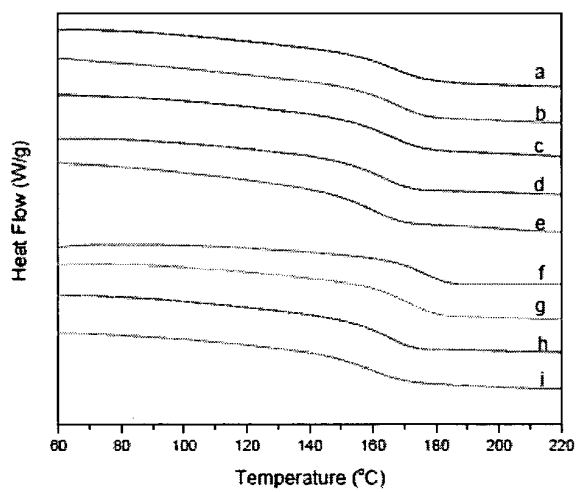
sample	E (GPa)	σ (MPa)	ϵ (%)	T^a (MJ m ⁻³)	T_g^b (°C)	T_d^c (°C)
neat CE-EP	2.61 ± 0.14	83.7 ± 3.3	5.0 ± 0.4	2.6 ± 0.2	167	305
SWNTs (0.2 wt %)/R	3.37 ± 0.07	103.1 ± 8.5	4.7 ± 0.7	3.0 ± 0.4	167	307
SWNTs(0.5 wt %)/R	3.38 ± 0.10	107.0 ± 11.0	4.7 ± 0.6	2.9 ± 0.2	165	311
SWNTs(1 wt %)/R	3.47 ± 0.18	100.1 ± 6.5	3.9 ± 0.4	2.5 ± 0.3	162	317
SWNTs(1.5 wt %)/R	3.10 ± 0.19	70.6 ± 4.6	2.5 ± 0.4	1.0 ± 0.2	159	318
SWNTs(0.2 wt %)/PI-BDA/R	3.48 ± 0.15	120.1 ± 2.7	6.2 ± 0.7	5.2 ± 0.6	175	308
SWNTs(0.5 wt %)/PI-BDA/R	3.87 ± 0.09	124.3 ± 2.2	4.8 ± 0.4	4.2 ± 0.3	170	317
SWNTs(1 wt %)/PI-BDA/R	4.70 ± 0.24	142.3 ± 6.9	4.2 ± 0.8	4.1 ± 0.4	164	323
SWNTs(1.5 wt %)/PI-BDA/R	4.40 ± 0.34	124.8 ± 9.6	3.7 ± 0.4	2.9 ± 0.3	160	320

^a Calculated from the area under the stress-strain curve. ^b The glass transition temperature determined by differential scanning calorimetry. ^c Thermal decomposition at 5 wt % weight loss.

FIG. 18



11/20

FIG. 19**FIG. 21**

12/20

FIG. 20

Ref. and year	CNT type	CNT treatment ^a	Processing Technique	CNT content (wt%)	Neat epoxy		CNT/epoxy		$d\sigma/dW_{NT}$ (MPa)	dE/dW_{NT} (GPa)
2003 ^{s12}	HiPco SWNTs	fluorination (cf)	solution mixing	1	83.2	2.026	95.0 (14%)	2.632 (30%)	1180	61
2004 ^{s13}	HiPco SWNTs	amino-modified (cf)	solution mixing	1	83	2.026	104 (25%)	2.650 (31%)	2100	62
2004 ^{s14}	DWNTs	amino-modified (cf)	calendering	1	63.8	3.29	65.2 (2%)	3.51 (7%)	140	22
2005 ^{s15}	CVD DWNTs	amino-modified (cf)	calendering	0.5	63.8	2.5999	69.13 (8%)	2.978 (15%)	1066	76
2005 ^{s16}	CVD MWNTs	no treatment (cf)	solution mixing	1.5	68	NA	80 (18%)	NA	800	NA
2006 ^{s17}	CVD MWNTs	plasma treatment (cf)	direct mixing	1	26	1.21	58 (123%)	1.61 (33%)	3200	40
2006 ^{s18}	SWNTs	acid treatment (cf)	solution mixing	0.1	64.8	2.875	68.4 (6%)	2.910 (1%)	3600	35
2007 ^{s19}	CVD MWNTs	maleic anhydride grafted (cf)	direct mixing	1	45	0.62	67.5 (50%)	1.25 (102%)	2250	63
2008 ^{s20}	SWNTs	poly(amidoamine) modified (cf)	solution mixing	1	64.1	2.76	74.7 (17%)	3.49 (26%)	1060	73
2009 ^{s21}	CVD SWNTs	poly(amidoamine) grafted (cf)	solution mixing	0.5	90	3.3	125.1 (39%)	3.89 (18%)	7020	118
2009 ^{s22}	MWNTs	acid treatment (cf)	solution mixing	0.5	73.4	2.67	74.4 (1%)	3.09 (16%)	200	84
2010 ^{s23}	CVD MWNTs	no treatment (cf)	direct mixing	10	64.51	3.11	110.1 (71%)	5.41 (74%)	456	23
our results	CVD SWNTs	Non-covalent functionalization	solution mixing	1	83.7	2.61	142.3 (70%)	4.70 (80%)	5860	209
				0.5					8120	252

^a cf in the bracket represents "covalent functionalization".^b The values in the bracket mean the increase of tensile modulus or strength over neat matrix.

13/20

FIG. 22

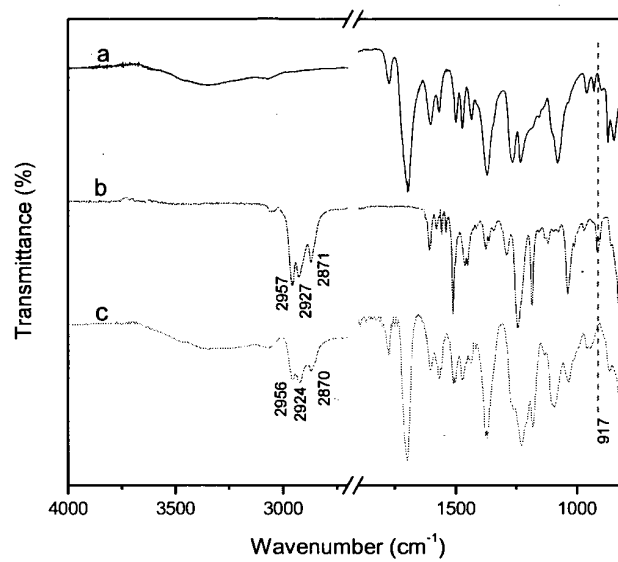
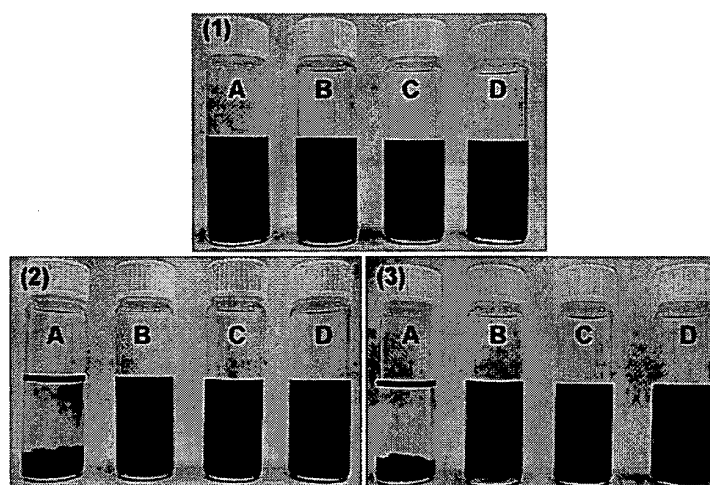
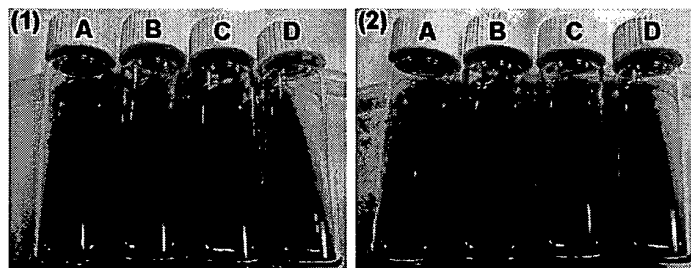


FIG. 23

(a)



(b)



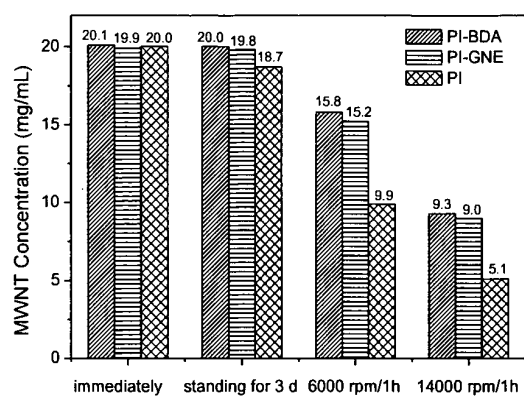
14/20
FIG. 24

FIG. 25

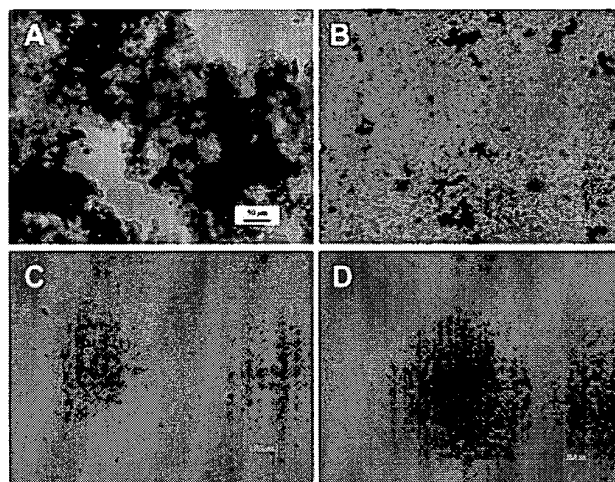
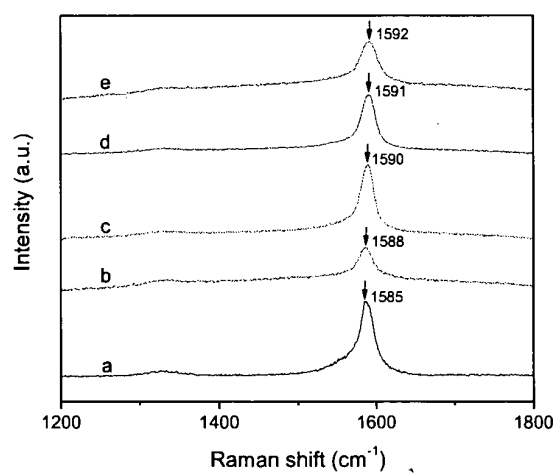


FIG. 27



15/20

FIG. 26

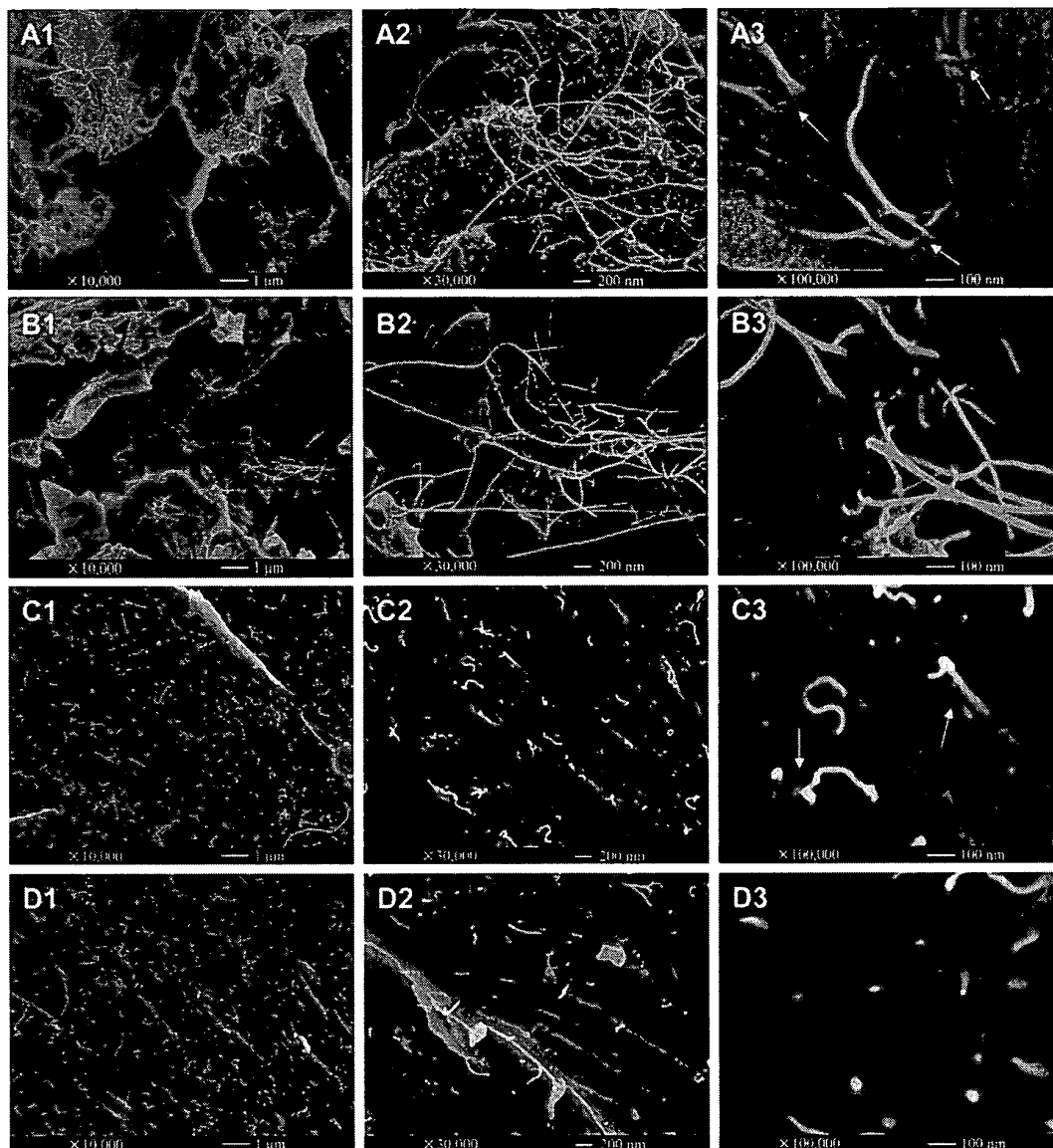


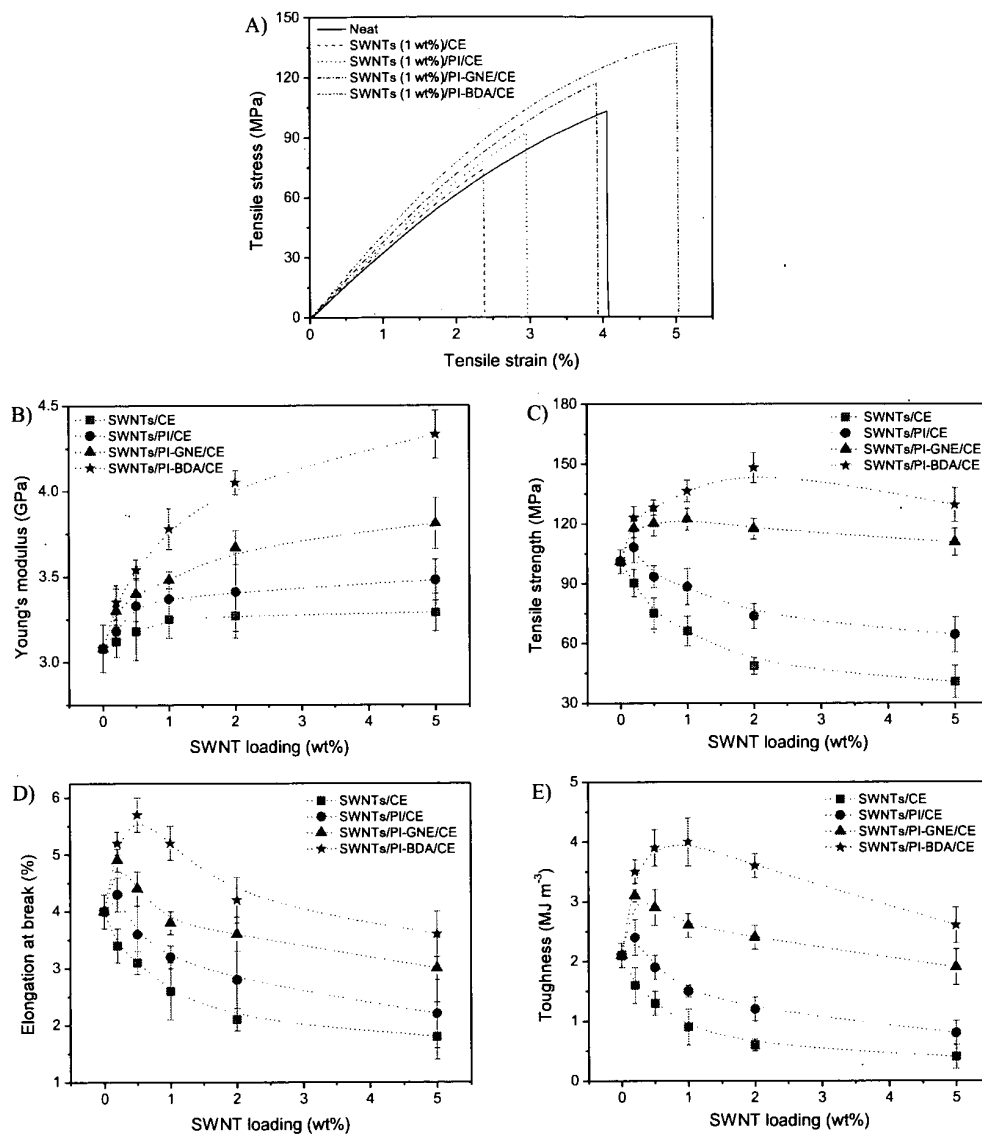
FIG. 28

Sample	E (GPa)	σ (MPa)	ϵ (%)	T^a (MJ m ⁻³)
Neat CE	3.08 ± 0.14	101.1 ± 6.0	4.0 ± 0.3	2.1 ± 0.2
SWNTs(0.2 wt%)/CE	3.12 ± 0.09	90.3 ± 6.8	3.4 ± 0.3	1.6 ± 0.3
SWNTs(0.5 wt%)/CE	3.18 ± 0.17	75.1 ± 7.8	3.1 ± 0.2	1.3 ± 0.2
SWNTs(1 wt%)/CE	3.25 ± 0.11	66.2 ± 7.4	2.6 ± 0.5	0.9 ± 0.3
SWNTs(2 wt%)/CE	3.27 ± 0.13	48.7 ± 4.3	2.1 ± 0.2	0.6 ± 0.1
SWNTs(5 wt%)/CE	3.29 ± 0.11	40.6 ± 8.2	1.8 ± 0.4	0.4 ± 0.2
SWNTs(0.2 wt%)/PI/CE	3.18 ± 0.04	108.3 ± 7.7	4.3 ± 0.3	2.4 ± 0.3
SWNTs(0.5 wt%)/PI/CE	3.33 ± 0.16	93.5 ± 5.5	3.6 ± 0.5	1.9 ± 0.2
SWNTs(1 wt%)/PI/CE	3.37 ± 0.10	88.4 ± 9.1	3.2 ± 0.2	1.5 ± 0.1
SWNTs(2 wt%)/PI/CE	3.41 ± 0.23	73.6 ± 6.3	2.8 ± 0.5	1.2 ± 0.2
SWNTs(5 wt%)/PI/CE	3.48 ± 0.12	64.3 ± 8.9	2.2 ± 0.6	0.8 ± 0.2
SWNTs(0.2 wt%)/PI-GNE/CE	3.30 ± 0.13	117.8 ± 4.8	4.9 ± 0.2	3.1 ± 0.1
SWNTs(0.5 wt%)/PI-GNE/CE	3.40 ± 0.16	120.2 ± 6.3	4.4 ± 0.3	2.9 ± 0.3
SWNTs(1 wt%)/PI-GNE/CE	3.48 ± 0.05	122.3 ± 5.6	3.8 ± 0.2	2.6 ± 0.2
SWNTs(2 wt%)/PI-GNE/CE	3.67 ± 0.10	117.5 ± 5.2	3.6 ± 0.3	2.4 ± 0.2
SWNTs(5 wt%)/PI-GNE/CE	3.81 ± 0.15	110.7 ± 6.8	3.0 ± 0.6	1.9 ± 0.3
SWNTs(0.2 wt%)/PI-BDA/CE	3.35 ± 0.10	123.0 ± 5.7	5.2 ± 0.2	3.5 ± 0.2
SWNTs(0.5 wt%)/PI-BDA/CE	3.54 ± 0.06	128.2 ± 3.8	5.7 ± 0.3	3.9 ± 0.3
SWNTs(1 wt%)/PI-BDA/CE	3.78 ± 0.12	136.5 ± 5.4	5.2 ± 0.3	4.0 ± 0.4
SWNTs(2 wt%)/PI-BDA/CE	4.05 ± 0.07	148.1 ± 7.6	4.2 ± 0.4	3.6 ± 0.2
SWNTs(5 wt%)/PI-BDA/CE	4.33 ± 0.14	129.4 ± 8.6	3.6 ± 0.4	2.6 ± 0.3

^a Calculated from the area under the stress-strain curve.

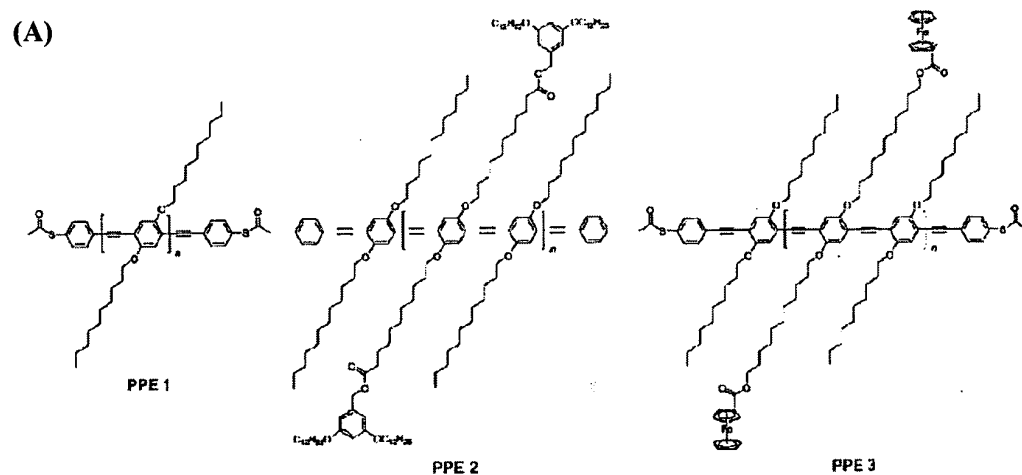
17/20

FIG. 29

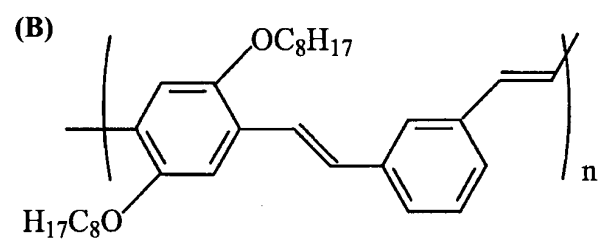


18/20

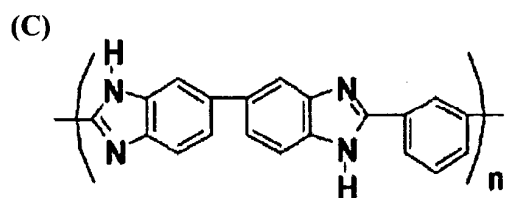
FIG. 30



Poly(phenylene ethynylene)s



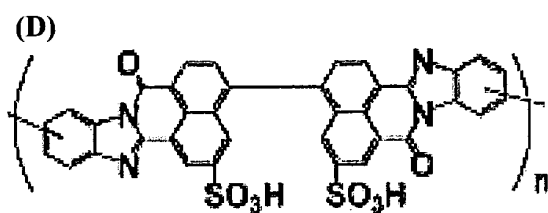
Poly(phenylene vinylene)



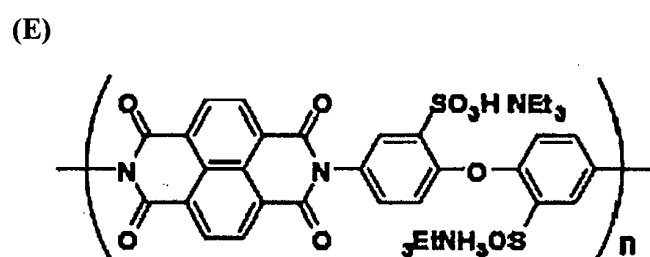
PBI

Polybenzimidazole

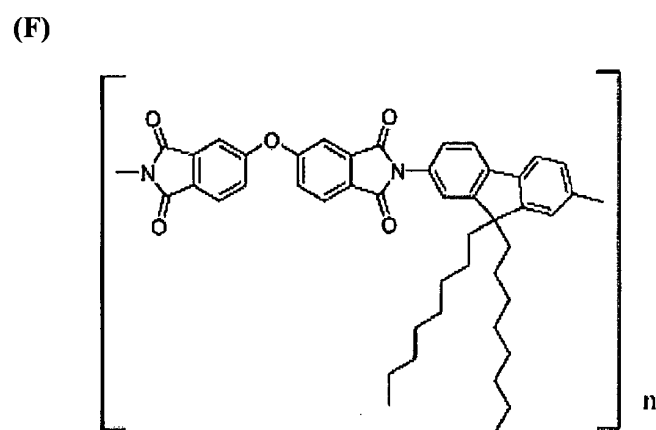
19/20



poly[bis(benzimidazobenzisoquinolinones)]



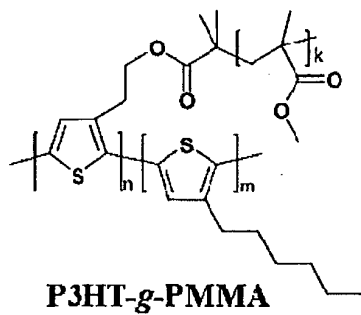
polyimide



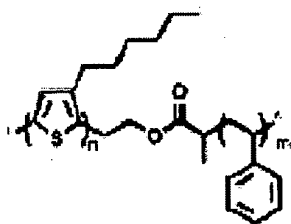
polyimide

20/20

(G)

Polythiophene-*graft*-poly(methyl methacrylate)

(H)

Poly(3-hexylthiophene)-*b*-polystyrene