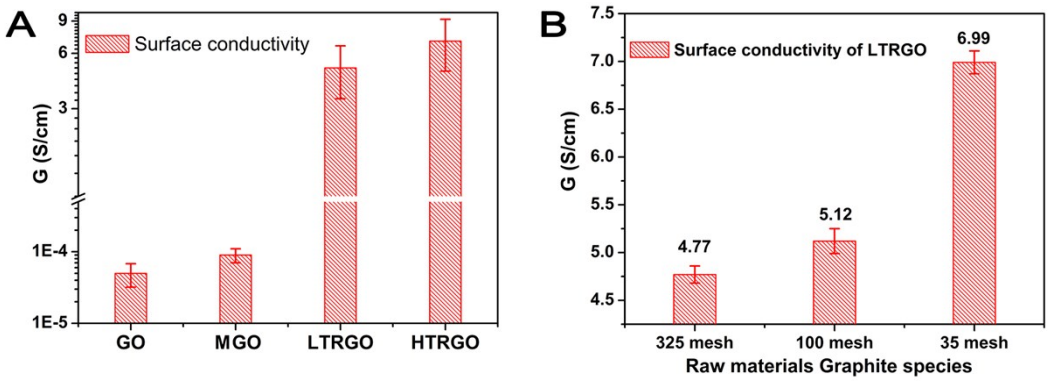
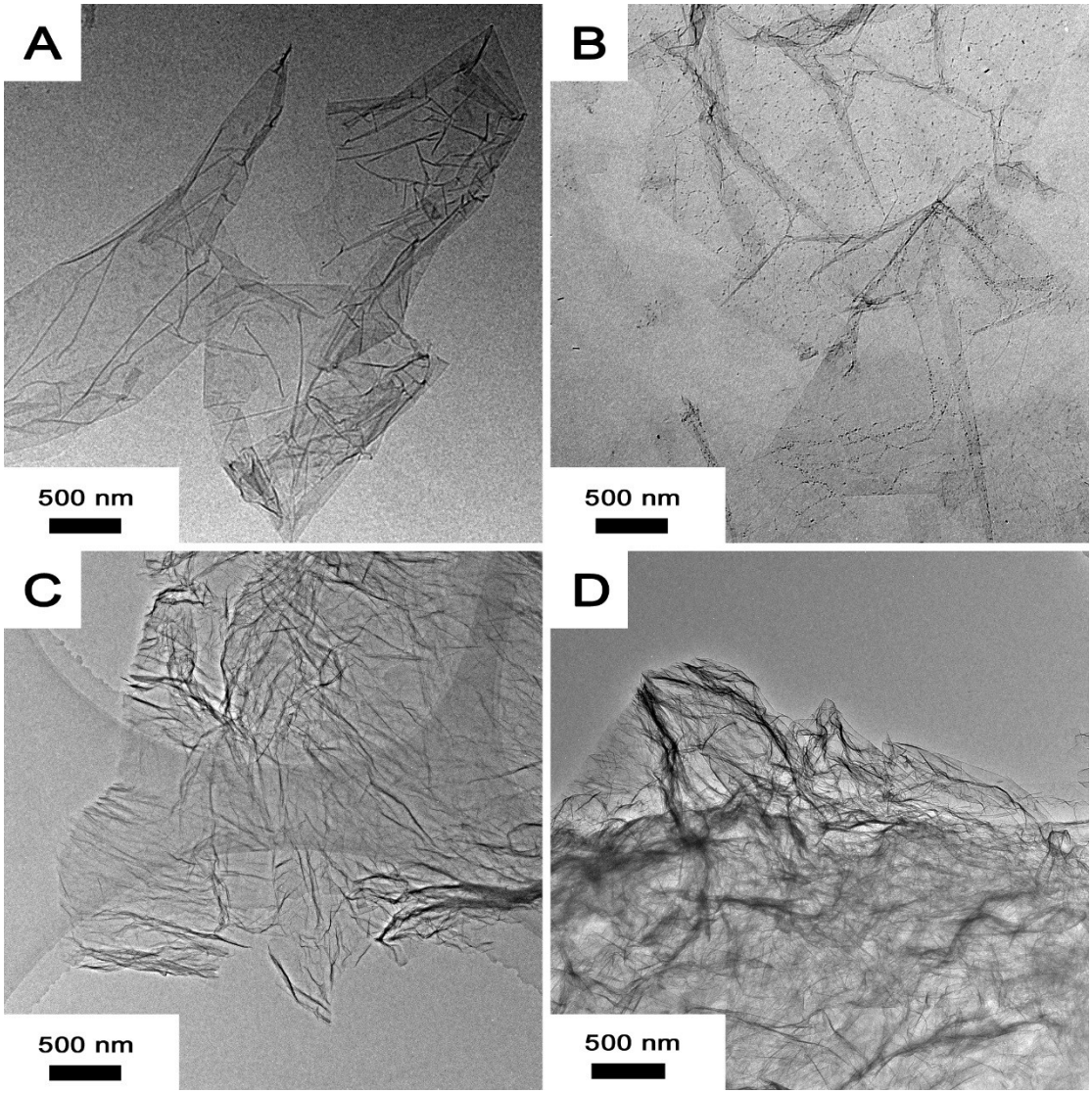
Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary materials

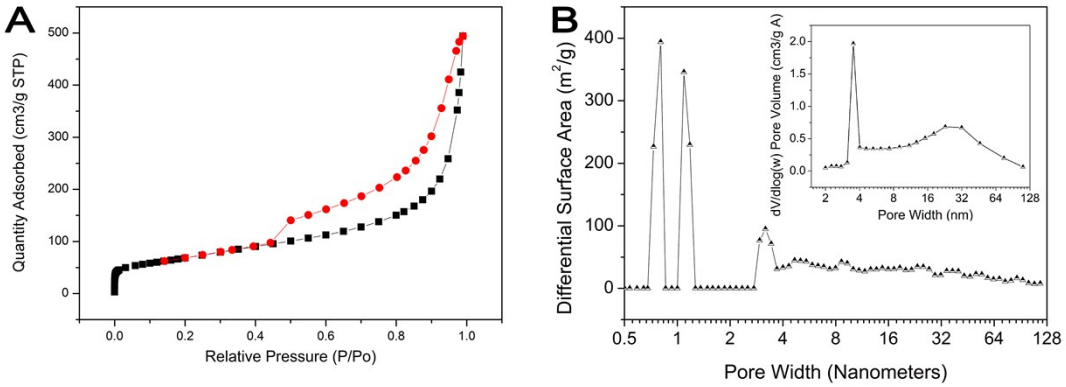
Accordion-like graphene by a facile and green synthesis method reinforcing polyolefin nano-composites



S 1 Surface electric conductivity of GO, MGO, M-LTRGO and M-HTRGO (A); the surface conductivity of LTRGO prepared from different mesh raw graphite (B). All the sample plates were compressed under the pressure of 50MPa and kept 45 minutes.



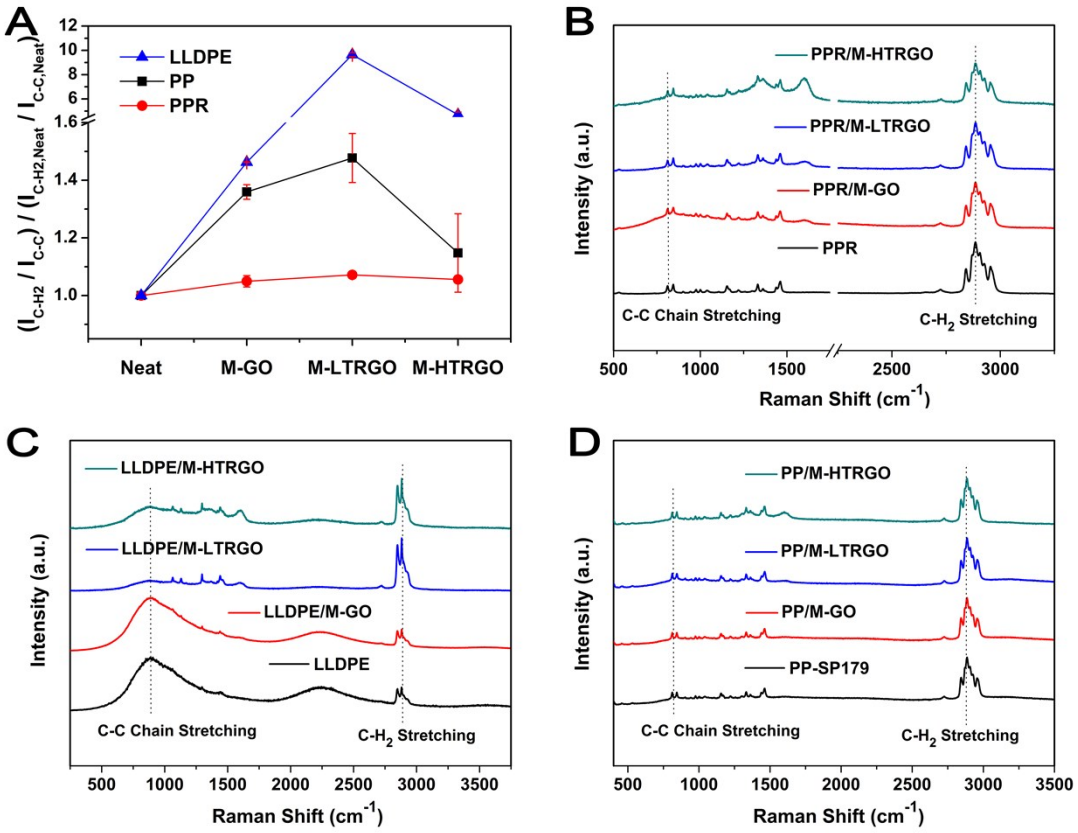
S 2 The TEM images of GO (A), MGO (B), M-LTRGO (C) and M-HTRGO (D)



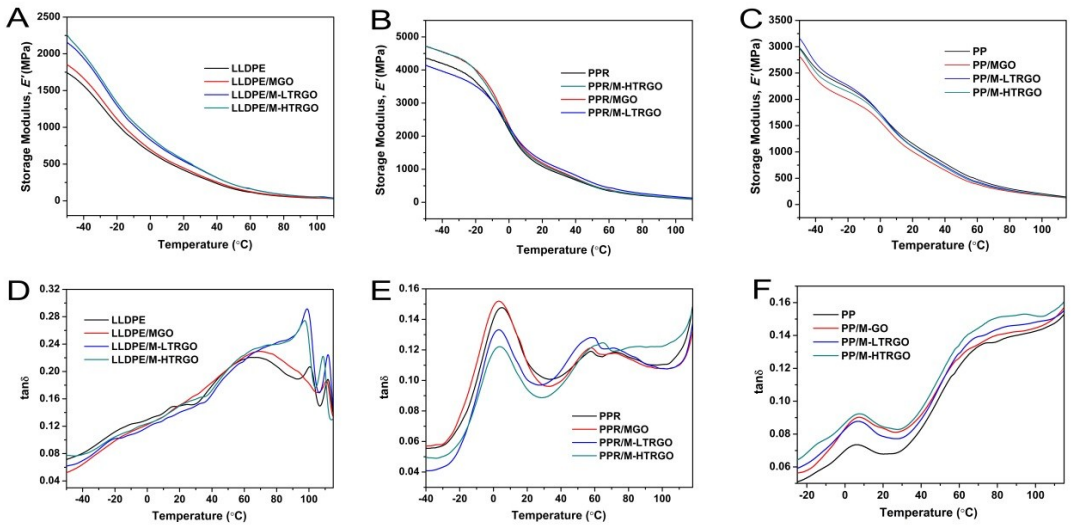
S 3 the adsorption-desorption curve (A) and the pore size distribution curve (B) of M-LTRGO

Table 1 the BET specific surface area dates of GO, MGO, M-LTRGO and M-HTRGO

sample	BET SSA (m2/g)	Pore size[nm]	pore volumes (V_t)
GO	2.666	32.073	0.0043
MGO	7.464	7.11	0.0155
M-LTRGO	359.103	12.472	1.1199
M-HTRGO	476.157	11.419	1.3593



S 4 RAMAN spectrums of graphene based polyolefin nano-composites



S 5 DMA curves of graphene-based polyolefin composites. (A, B, C) storage modulus (E') and (D, E, F) loss factor (tan δ) of (LLDPE, PPR, PP) composites.

Table 2 Mechanical properties of PP-SP179 nano-composites

Sample	Tensile yield strength (MPa) (Improvement rate)	Tensile breaking strength (MPa) (Improvement rate)	Elongation at break (%) (Improvement rate)	Bending modulus (MPa) (Improvement rate)	Impact energy (J/m^2) (Improvement rate)
PP-SP179	20.15	14.00	138.00	815	14
PP/M-GO	18.71 (-7.15%)	11.50 (-17.86%)	30.20 (-78.12%)	910 (11.66%)	14.6 (4.28%)
PP/M-LTRGO	19.40 (-3.12%)	14.10 (0.71%)	146.00 (5.80%)	984 (20.74%)	16 (14.28%)
PP/M-HTRGO	19.52 (-3.72%)	12.82 (-8.23%)	62.34 (-54.83%)	896 (9.94%)	12.82 (-8.23%)

Table 3 Mechanical properties of PPR nano-composites

Sample	Tensile yield strength (MPa) (Improvement rate)	Tensile breaking strength (MPa) (Improvement rate)	Elongation at break (%) (Improvement rate)	Bending modulus (MPa) (Improvement rate)	Impact energy (J/m^2) (Improvement rate)
PPR	24.21	26.89	452.89	682.62	59.13
PPR/M-GO	24.84 (2.60%)	31.53 (17.26%)	464.58 (2.58%)	697.56 (2.19%)	37.26 (-36.98%)
PPR/M-LTRGO	25.99 (7.35%)	38.39 (42.77%)	508.5 (12.28%)	757.54 (10.98%)	42.97 (-27.33%)
PPR/M-HTRGO	24.98 (3.18%)	32.97 (22.61%)	488.95 (7.96%)	707.05 (3.58%)	25.38 (-57.08%)

Table 4 Mechanical properties of LLDPE nano-composites

Sample	Tensile yield strength (MPa) (Improvement rate)	Tensile breaking strength (MPa) (Improvement rate)	Elongation at break (%) (Improvement rate)	Flexural modulus (MPa) (Improvement rate)	Charpy impact strength(KJ/m^2) (Improvement rate)
LLDPE	64.05	11.47	425.8	194.98	64.05
LLDPE/M-GO	61.67 （-3.72%）	15.39 (34.18%)	565.53 (32.82%)	203.96 (4.61%)	61.67 （-3.72%）
LLDPE/M-LTRGO	66.717 （4.16%）	18.19 (58.59%)	570.99 (34.10%)	230.51 (18.22%)	66.717 （4.16%）
LLDPE/M-HTRGO	66.04 （3.11%）	13.825 (20.53%)	570 (33.87%)	221.35 (13.52%)	66.04 （3.11%）

Table 5 Thermal stability of the graphene based polyolefin nano-composites

Graphene species	LLPDE	PPR	PP
	T_{d20} / $T_{d, max}$ (°C)		
NEAT	417/445	370/423	327/397
M-GO	420/451	377/429	329/413
M-LTRGO	437/465	402/439	348/435
M-HTRGO	432/463	381/435	360/427

T_{d20}: Value determined by the weight loss of 20 wt.%; $T_{d, max}$: the peak value of the 1st derivative profiles derived from the TGA curves. Heating rate is all 10°C/min.