Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Electronic Supplementary Information (ESI)

High-performance Thermal Conductive and Electromagnetic Interference Shielding Composites from Multilayer Plastic Packaging Waste and Expanded Graphite

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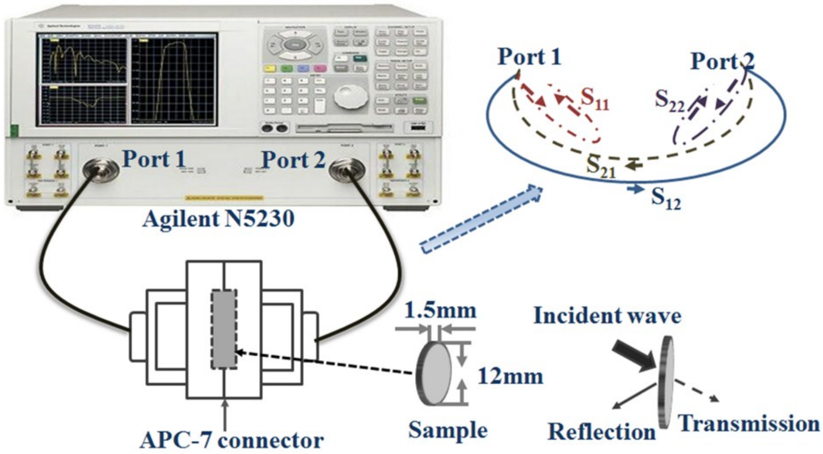

Fig S1 A demonstration of shielding measurement setup and specimen

Fig.S1 present the EMI shielding measurement setup. The electromagnetic shielding characteristics of MPW/EG-PM and LLDPE/EG composite were determined using a precision coaxial test cell (APC-7 connector) with a two ports Agilent N5230 vector network analyzer, according to ASTM ES7-83. In order to measure the scattering parameters (S_{11} and S_{21}), circular samples with 12 mm in diameter and 1.5mm in thickness were prepared to fix in the axially connected specimen holder and were connected through the Agilent N5230 coaxial line to ports of vector network analyzer. When the waveguide scattered after interaction with the sample, the scattering signal was recorded in in term of scattering parameters. The measured scattering parameters (S_{11} and S_{21}) were used to calculate the power coefficients of reflectivity (R), transmissivity (T), and absorptivity (A). Then the EMI SE including the total SE (SE), reflection shielding (SE_R), absorption shielding (SE_A) and multiple reflection (SE_M) can be obtained using the following equations

$$R = |S_{11}|^2 \tag{1}$$

$$A = |S_{21}|^2 \tag{2}$$

$$A = 1 - R - T \tag{3}$$

$$SE_R = -10 \log_{10}(1 - R) \tag{4}$$

$$SE_A = -10 \log_{10}(T/(1 - R)) \tag{5}$$

$$SE = SE_A + SE_R + SE_M \tag{6}$$

SE_M usually can be neglected when SE > 10-15dB[1-4].

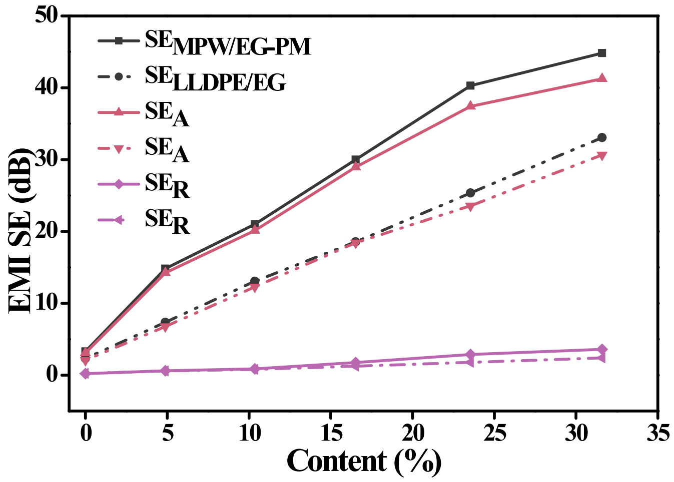

Fig S2 Comparison of SE, SE_A, and SE_R at the frequency of 8.2 GHz for MPW/EG-PM and LLDPE/EG composites with various filler contents

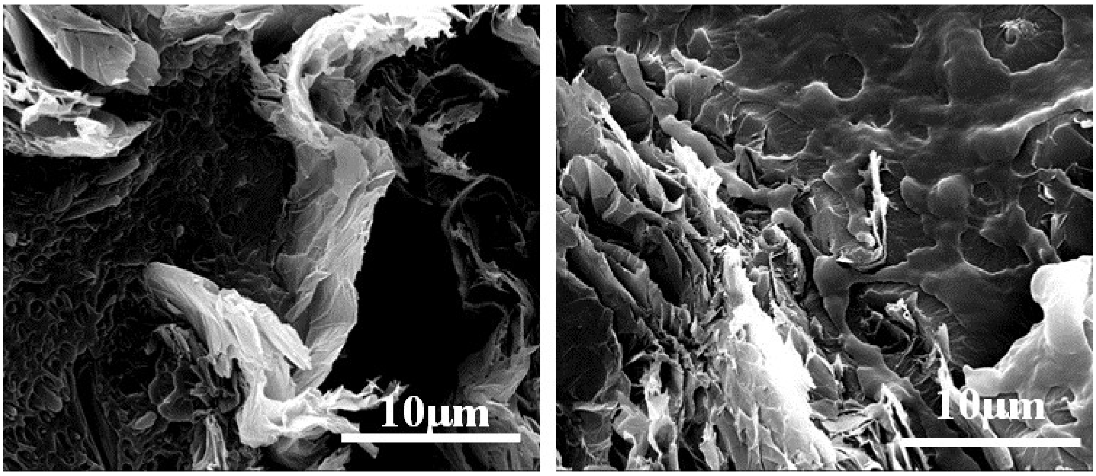

Fig S3 SEM micrograph of fracture surface of (a) MPW/EG-PM composites and (b) LLDPE/EG composites

Table S1 Major parameters used in the simulation

Parameters	LLDPE	MPW	EG
Thermal conductivity (W/(m K))	0.39	0.41	139
Specific heat capacity (J/(g K))	2300	2100	710
Density (kg/m^3)	940	960	2250

Note: in a 2D analysis type only isotropic thermal conductivity can be defined

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