

## Supplementary Information

### Intense nonlinear dielectric and magnetic resonances to improve the microwave absorption properties of core/shell Ni@graphene composites

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#### 1. Morphology and particle size of the raw Ni powder

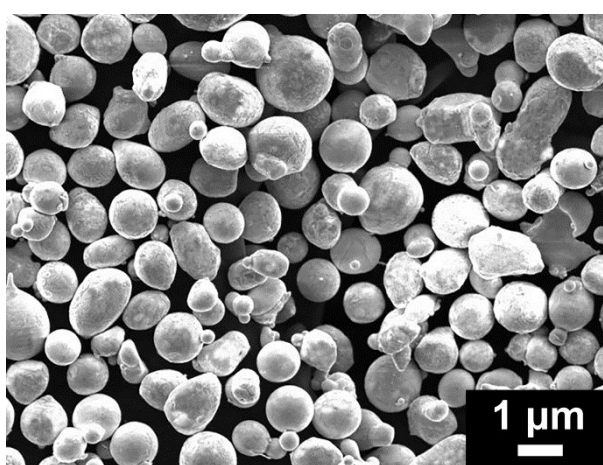


Figure S1 FESEM image of the pure Ni particles

#### 2. The 2D bands in the Raman spectra of the Ni@graphene composites

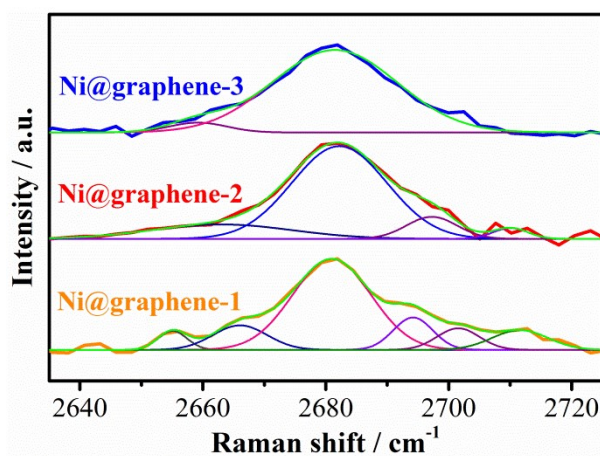


Figure S2 The enlarged 2D-band regions with the curve fit

3. **Table S1** Normalized intensities of the D, G, and 2D bands, and the ratio of  $I_D/I_G$  and  $I_{2D}/I_G$  of the Raman spectra for the Ni@graphene composites synthesized under different PMMA content

Process parameters		Raman Spectra				
PMMA content (mg/mL)	Temperature (°C)	$I_D$	$I_G$	$I_{2D}$	$I_D/I_G$	$I_{2D}/I_G$
0.5	900	0.2548	0.1529	0.6848	1.6664	4.4787
1.0	900	0.1039	0.1081	0.7392	0.9611	6.8381
1.5	900	0.1763	0.2168	0.7490	0.8132	3.4548

4. FESEM images of the Ni@graphene composites

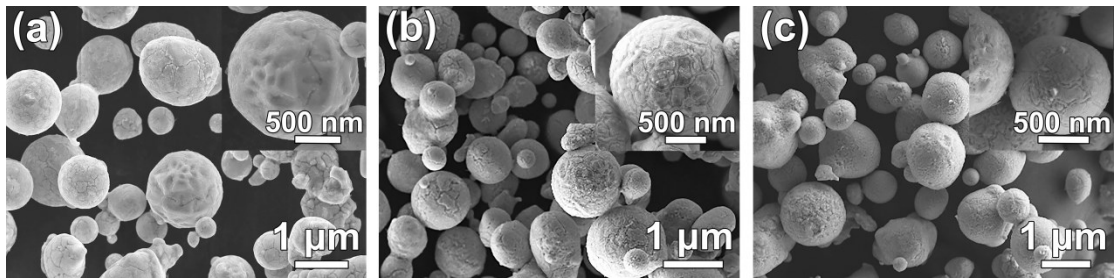


Figure S3 The morphology of the Ni@graphene composites

5. The complex permittivity and permeability at the resonant frequency region

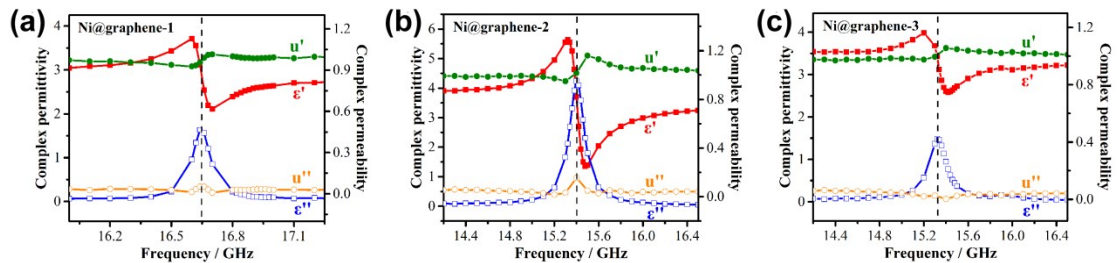


Figure S4 The complex permittivity and permeability of the Ni@graphene composites at the resonant frequency region

## 6. Dielectric and magnetic loss of Ni@graphene composites

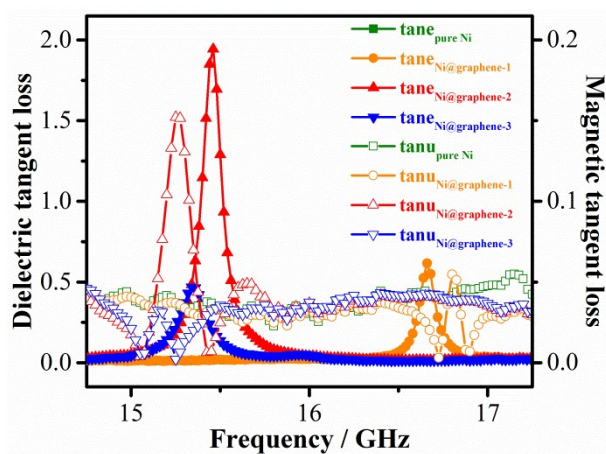


Figure S5 Dielectric tangent loss and magnetic tangent loss of the samples