Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Growth of turbostratic stacked graphene using waste ferric chloride solution as a feedstock

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Preparation of graphene on nickel foam

The graphene on nickel foam was prepared by an ambient pressure chemical vapor deposition method (AP-CVD) using solid waste plastic as a carbon source. The AP-CVD system consisted of a long quartz tube and 2 furnaces as shown in Fig. S1. 0.5 g waste plastic straw and a 3×20 cm^2 nickel foam sheet were placed in the zone of furnace 1 and furnace 2, respectively. Then, the air in the quartz tube was evacuated by introducing argon gas for 30 minutes. After that the nickel foam was heated to the graphene growth temperature at 800 °C by furnace 2. At this growth temperature, the vapor of waste plastic straw was introduced by annealing the waste plastic straw at 500°C using furnace 1 for 30 minutes. Subsequently, the sample was fast cooled down to room temperature. Finally, the graphene on nickel foam was obtained.

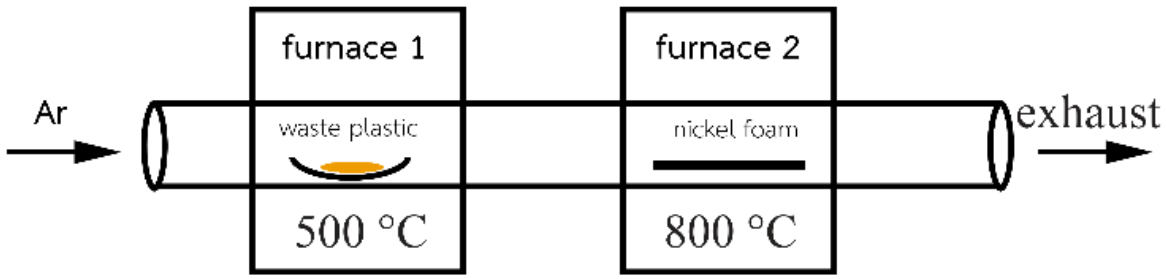

Fig. S1 Schematic of experimental setup of graphene foam synthesis by CVD using waste plastic as a carbon source.

Etching nickel from graphene on nickel form

In order to obtain pure graphene foam, the as-grown graphene on nickel foam was immersed in $FeCl_3$ overnight to etch the nickel. Fig. S2 shows X-ray diffraction (XRD) results measured on the sample before (blue) and after (red) immersion in $FeCl_3$. The XRD pattern of the sample before immersion in $FeCl_3$ displays the high intensity of nickel at ~44°. The absence of graphene pattern can be attributed to impeding the X-ray scattering of graphene by nickel. After immersing the sample in $FeCl_3$, the XRD results display the graphene peak at ~25°. The XRD patterns of $FeCl_3$[1], $FeCl_2$[1] and FeO[2] also appear on the sample implying the surface of graphene foam is contaminated with these compounds. However, these compound contaminants can be

removed from the surface of graphene foam by immersing the graphene foam in HCl overnight (Fig. S2 (green)).

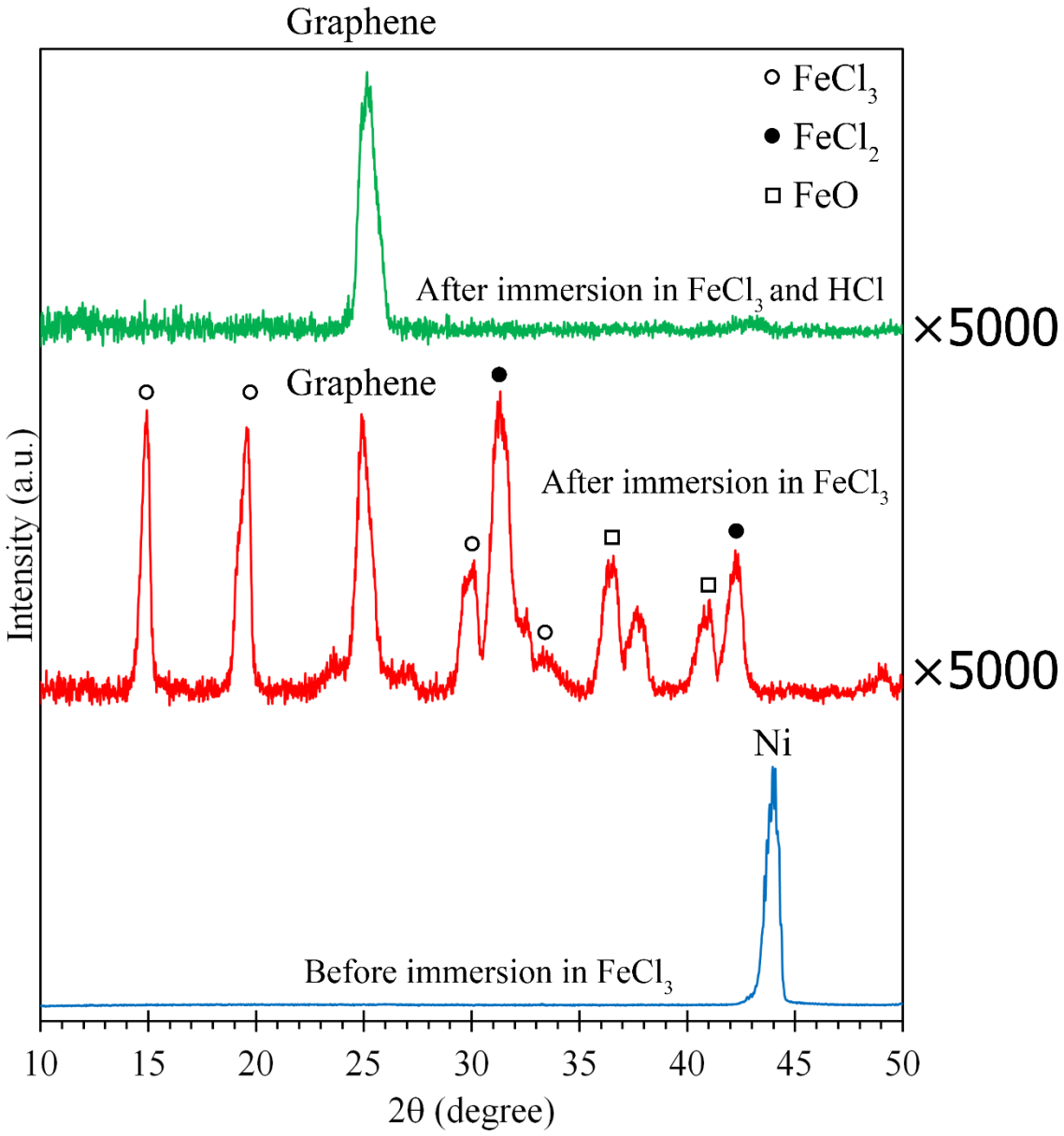

Fig. S2 XRD patterns of sample before (blue) and after (red) immersion in $FeCl_3$ and after immersion in $FeCl_3$ and HCl (green).

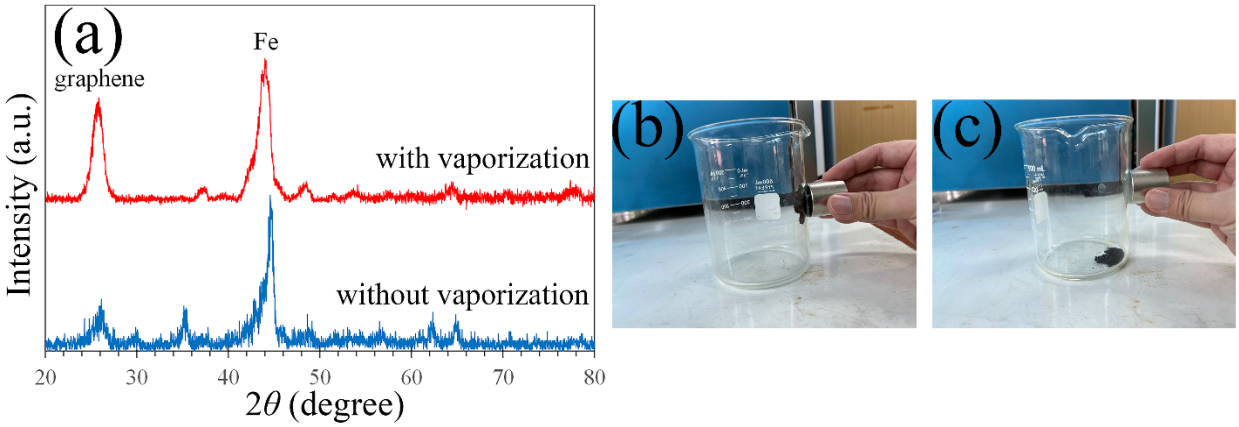

Fig. S3 (a) XRD patterns of GFeNi0 prepared with (red) and without (blue) vaporization process. (b) and (c) photos of GFeNi2.5981 before (b) and after (c) etching the metal inside by immersion in HCl.

Table S1 Parameters for XRD curve fitting on GFeNi2.5981.

d_j (Å)	β_0	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9	β_{10}	β_{11}
3.42	1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45

Table S2 Information of graphene structure of GFeNi2.5981

graphene layer spacing	graphene thickness											
	1 layer	2 layers	3 layers	4 layers	5 layers	6 layers	7 layers	8 layers	9 layers	10 layers	11 layers	12 layers
3.42 Å	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	45%

References

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