Electronic Supplementary Information

Controllable growth of metals on graphene nanosheets

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Experimental

The graphene oxides were synthesized by chemical exfoliation of natural graphite. In brief, 5 g of graphite powder (average size 20 μm, apparent density 0.05 g cm^{-3}) and 5 g of $NaNO_3$ were added into 230 mL of 98% H_2SO_4 under stirring in an ice bath. 30 g of $KMnO_4$ was slowly added to the mixture under stirring for 15 min at below 5 °C. The mixture was then heated at 35°C for 30 min. Subsequently, 460 ml of distilled water was slowly added into the above mixture, followed by stirring the mixture at 98 °C for more than 15 min. The mixture was further diluted with 1400 mL of distilled water and the reaction was terminated by adding 25 mL of 30 % H_2O_2. Meanwhile, the color of the solution turned from dark brown to bright yellow. The resulting mixture was filtered and washed with distilled water several times to remove residual acids and salts. As-prepared GO was dispersed in water by ultrasonication for 30 min, followed by a low-speed centrifugation to get rid of any aggregated GO nanosheets.

The metal nanoparticles or layers functionalized graphene composites were synthesized through modified electroless plating. Firstly, 250mg of GO was suspended in 50 mL of deionized water and sonicated for 3 h in an ultrasonic bath. Then the suspension was transferred into a conical flask. 5mL of K_2PdCl_4 (0.034g) solution was added into the GO suspension in an ice bath with vigorous stirring for 30 min. The resulting product was then collected by centrifugation and washed three times with deionized water. Subsequently, the as-synthesized product was added into 50 mL of electroless plating solution in a conical flask. The electroless Nickel plating solution contained 1.68 g of $NiCl_2{\cdot}6H_2O$, 2.5 g of $Na_3C_6H_5O_7{\cdot}2H_2O$, 1.68 g of NH_4Cl and 0.44 g of $NaH_2PO_2{\cdot}H_2O$. The electroless Cobalt plating solution contained 1.19 g of $CoCl_2{\cdot}6H_2O$, 8.82 g of $Na_3C_6H_5O_7{\cdot}2H_2O$, 2.67 g of NH_4Cl and 2.65 g of $NaH_2PO_2{\cdot}H_2O$. The pH of the electroless plating solution was then adjusted to 8~10 by the dilute ammonia water. The mixture solution was heated at 70~80 °C with stirring under N_2 protection for 20~100 min. The final product was collected by centrifugation, washed with deionized water three times and dried at 50 °C in the oven.

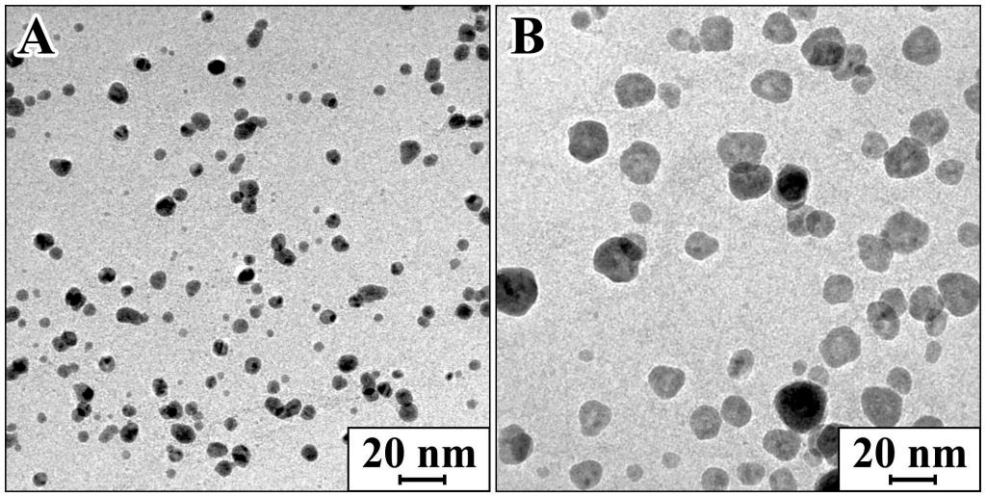

Fig. S1 TEM images of (A) GO-Pd and (B) G-Ni20-L.

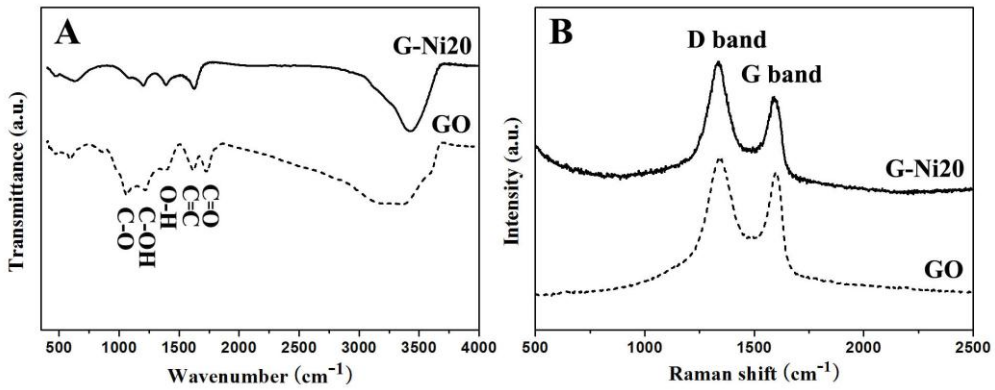

Fig. S2 (A) FT-IR and (B) Raman spectra of GO and G-Ni20.

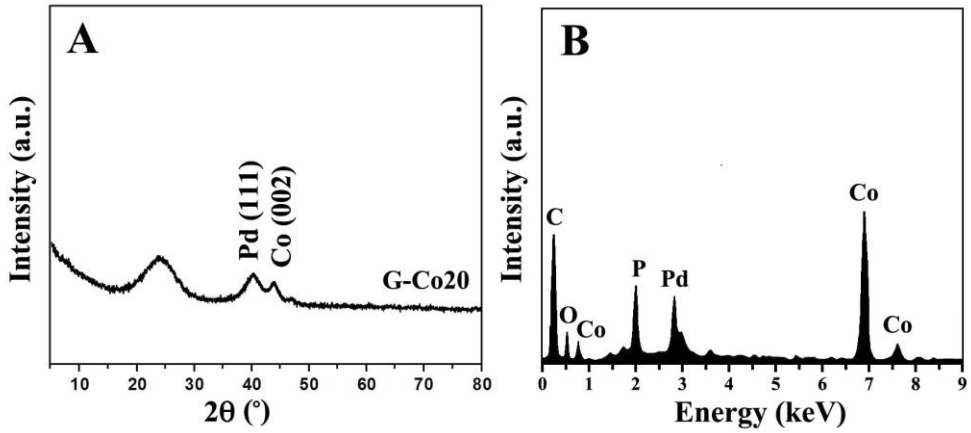

Fig. S3 (A) XRD pattern and (B) EDX spectrum of G-Co20.

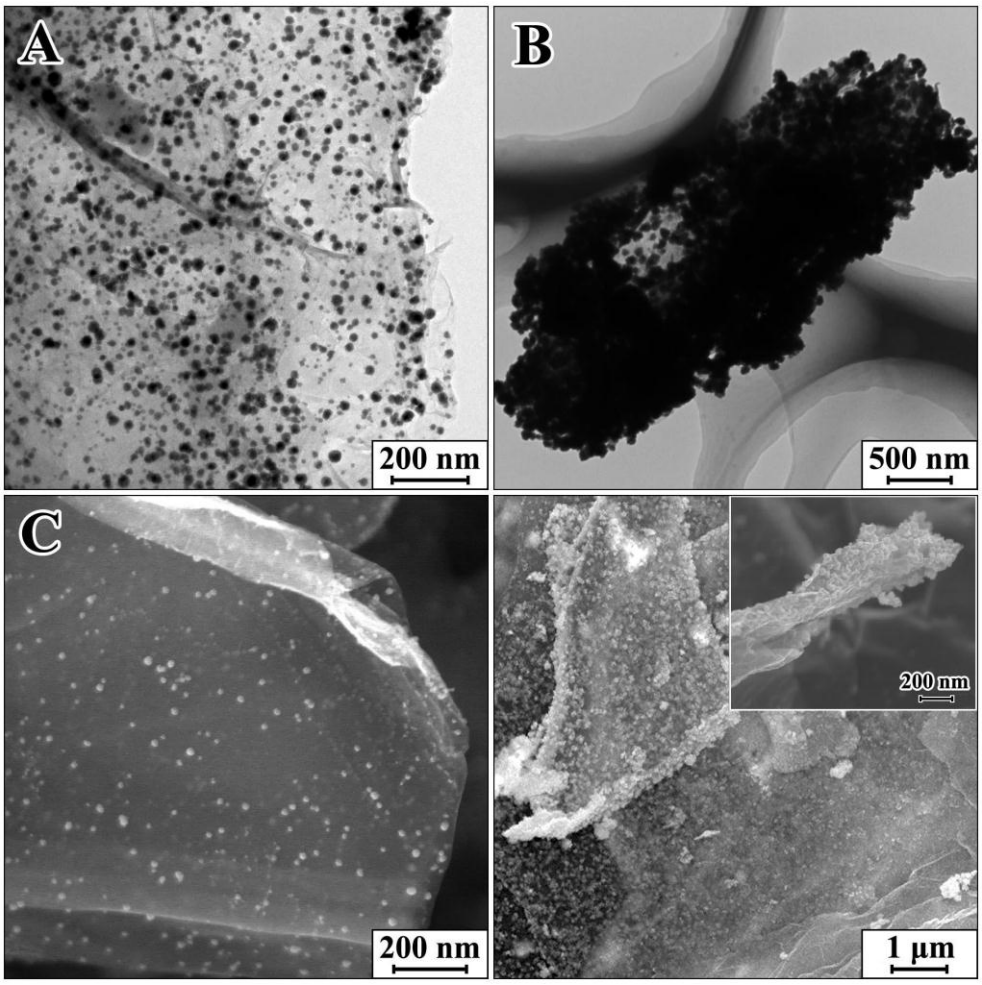

Fig. S4 TEM and SEM images of (A, C) G-Co20 and (B, D) G-Co100, respectively. The inset of (D) is the cross-section of G-Co100.