Electronic Supplementary Information for

A pH-sensitive Graphene Oxide Composite Hydrogel

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1. Experiments

1.1 Materials

Graphite was bought from Qingdao Huatai lubricant sealing S&T Co. Ltd (Qingdao, China). Vitamin B_{12} was purchased from Beijing Dingguo bio-tech Co. Ltd (Beijing, China). Poly(vinyl alcohol) with repeat unit number of 2400~2500 (PVA 124, hydrolysis degree 98~99%) and all the other chemicals are products of Beijing Chem. Reagents Co (Beijing, China). They were used as received without further purification. Deionized water was used throughout the work.

1.2 Instruments

SEM images were recorded on a FEI Quanta 200 scanning electron microscope. XRD patterns were taken out by the use of a Rigaku D/MAX 2500 diffractometer with CuKα radiation (λ=1.54056 Å). The UV/Vis spectra were carried out using a U-3010 UV/Vis spectrometer (Hitachi). Atomic force microscopic (AFM) images were performed by the use of a Nanoscope III MultiMode SPM (Digital Instruments) with an AS-12 (“E”) scanner operated in tapping mode in conjunction with a V-shaped tapping tip (Applied Nanostructures SPM model: ACTA). The images were recorded at a scan rate of 2 Hz. Rhoelogical studies were performed on a MCR 300 (Paar Physica) Rheometer.

1.3 Drug release test

The VB12-loaded hydrogel for drug release was prepared through the same procedure

of preparing GO/PVA composite gel as described in the main text, except that a PVA/VB12 blend solution was used in this case. The finial hydrogel ($r_{P/G}$ = 1:10) contains 5 mg mL^{-1} GO and 3 mM VB12. To test the drug release profiles in PBS (pH= 7.4) and HCl (pH=1.7) solutions, 50 μL VB12-loaded hydrogel was injected into a small plastic tube with opened mouth. Then the plastic tube with the gel was immersed into 5 mL PBS or HCl solution in a glass vessel. Successively, the solution was kept undisturbed in dark for a certain time and then its absorbance was measured by transferring 3 mL solution into a standard UV-vis cuvette with a pipette. After each spectral measurement, the solution in cuvette was put back into the vessel. The amount of the released VB12 was calculated according to the absorbance of the solution. The final release curves were plotted with the average data of three measurements.

2. **Characterization of GO**

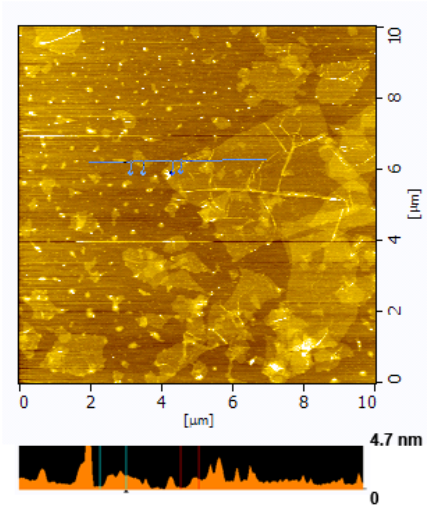

Fig. S1. AFM image of GO nanosheets on a mica surface. The thickness of GO sheet was measured to be ~1.2 nm.

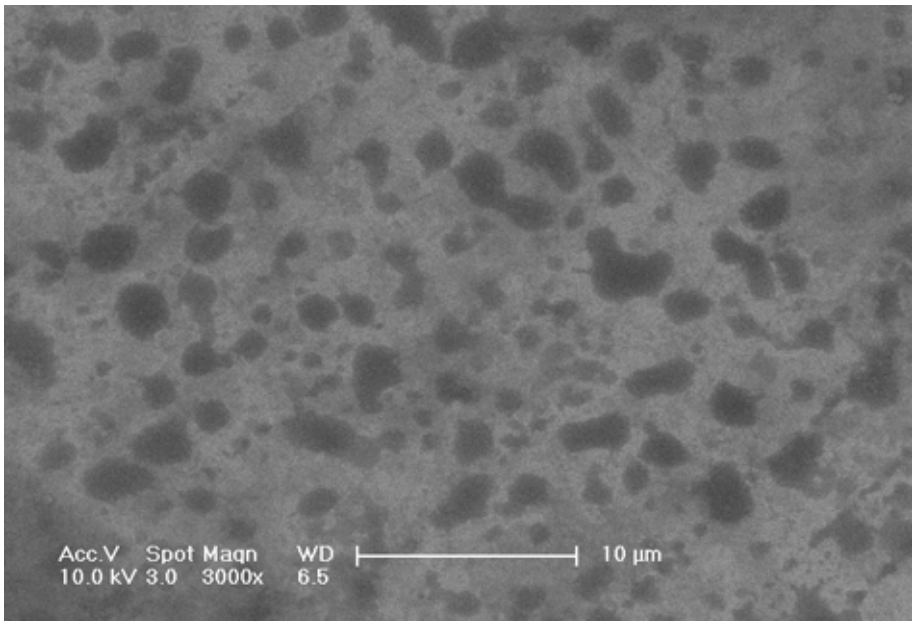

Fig. S2. SEM image of GO nanosheets on an ITO glass sheet.

3. **Rheology studies of the GO/PVA blend solutions and hydrogels.**

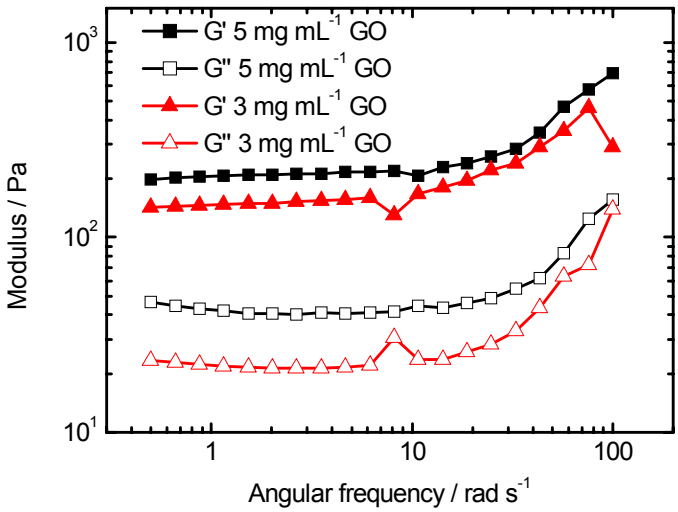

Fig. S3. Dynamic rheological behavior of GO/PVA hydrogel ($r_{P/G}$ = 1:2) containing 3 (red dots) or 5 mg mL^{-1} GO (black dots). G' and G'' are the storage and lost moduli of the hydrogel, respectively. These data were obtained by using a 25 mm diameter parallel-plate with 1 mm plate-plate gap and the strain was controlled to be 0.2%.

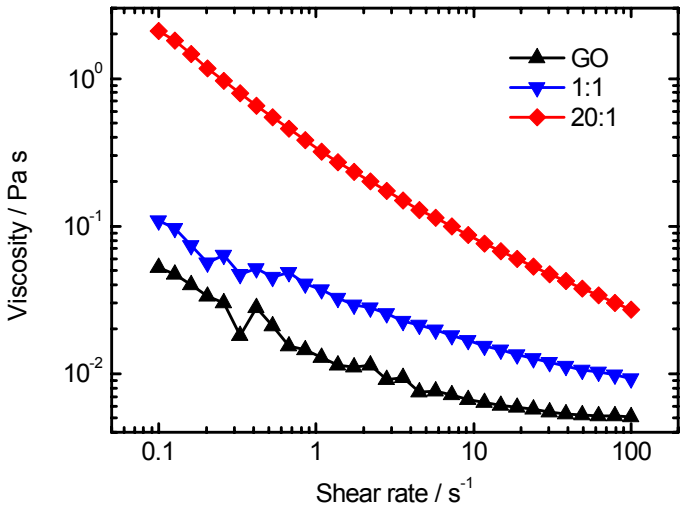

Fig. S4. Viscosities of GO and GO/PVA blend solution at different shear rates. These data were collected using a couette fixture (i.d.=28.5 mm, o.d.= 39 mm).

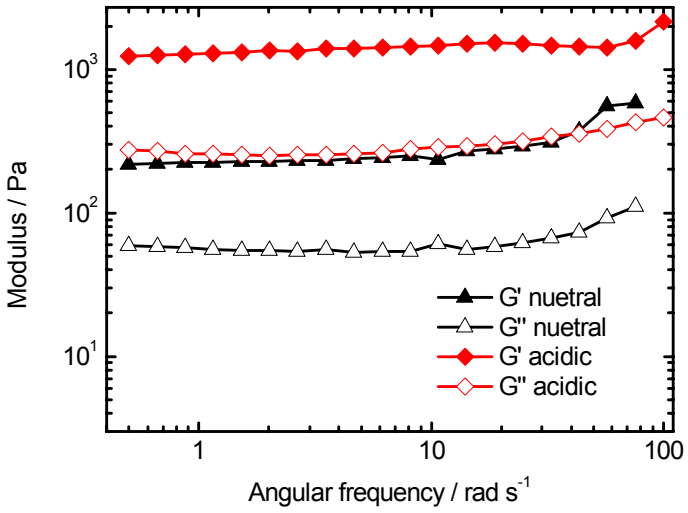

Fig. S5. Dynamic rheological behaviors of a GO/PVA hydrogel ($r_{P/G}$ = 1:10) in its neutral and acidic (pH~1) states, respectively. The measurement condition was the same as that described in Fig. S3.