### **Supporting Information (SI)**

## An Enhanced Fluorescence Based on Graphene Self-assembled

# Films and Highly Sensitive Sensing for VB<sub>12</sub>

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#### S-1. Materials

Gr, Gr oxide (GO) and N-doped Gr (NGr) powder were purchased from Nanjing Xianfeng Nano Co. Ltd (Nanjing, China) and used without further purification. Gr sheets were prepared by a physical mechanical stripping method. Chitosan (M.W. 100,000-300,000) was purchased from Aladdin Chemical Reagent Co. Ltd (China). FTO glasses were purchased from Wuhan Jinge solar energy technology Company (China). Acetic acid (CH<sub>3</sub>COOH), K<sub>3</sub>[Fe(CN)<sub>6</sub>] and K<sub>4</sub>[Fe(CN)<sub>6</sub>]·3H<sub>2</sub>O were purchased from Sinopharm Chemical Reagent Company (China). Poly(diallyldimethylammonium chloride) (PDDA, M.W. 100,000-200,000) was obtained from J & K Chemical. Poly(styrenesulfonate) (PSS, M.W. 70,000) was purchased from Acros (USA). All other reagents were analytical grade and used without further purification. Water used for the preparation procedure was purified by a Millipore Milli-Q water purification system (USA).

#### S-2. Spectral characteristic of reduced Graphene Oxide film and CDs aqueous solution



Figure S1. Fluorescence spectra of CDs has a overlap with the absorption spectra of rGO film

#### S-3. Optimization of electric deposition condition for graphene films(GrF)



Figure S2. SEM images of FTO/CS-Gr with different electrodeposition time



Figure S3. Fluorecence spectra of CDs on the FTO/CS SAMs (black) and FTO/CS-Gr SAMs (red) with different electrodeposition time



**Figure S4.** Electrochemical impedance spectra (A) and Cyclic voltammograms (B) o GrF with different electricdeposition potential. (a) -0.5 V, (b) -0.7 V, (c) -0.9 V, (d) -1.1 V, (e) -1.3 V. Scan rate shown: 100 mV/s (vs.SCE), Frequency range: 100 KHz to 0.1Hz.

### S-4. Fluorescence decay curve of SEF SAMs



**Figure S5.** Fluorescence decay of CDs on the FTO/CS SAMs and FTO/CS-Gr SAMs as a function of spacer (PDDA/PSS)n (n = 1-5) bilayers. Instrument response function (IRF) is also indicated

#### S-5. Spectral characteristic of SEF SAMs respond to VB12



Figure S6. (A) The absorption spectra (green) of  $VB_{12}$  and fluorescence excitation (red) and emission (black) spectra of GrF SAMs in pH=6.98 PB buffer; (B)fluorescence decay curve of GrF SAMs in the absence and presence of  $VB_{12}$ 

S-6. Influence of fluorescence probe type on fluorescence enhancement in SEF systems



**Figure S7.** The fluorescence spectra of (A) Fluorescein isothiocyanate (FITC) and (B) Rhodamine B (RhB) on the FTO/CS SAMs (black) and FTO/CS-Gr SAMs (red)

#### S-7. Influence of excitation wavelength on fluorescence enhancement in SEF systems



Figure S8 Fluorecence spectra of CDs on the FTO/CS SAMs (black) and FTO/CS-Gr SAMs (red) with different excitation wavelength

S-8. The light stability spectra of CDs



Figure S9 (A) The fluorescence spectra and (B)intensity of CDs for different irradiating time under UV lamp



S-9. The Raman and FETEM characterization of FTO/GrF

Figure S10 (A) Raman spectra and (B) SEM image of the FTO/GrF