

## Supplementary Material

### Recyclable Textiles Functionalized with Reduced Graphene Oxide@ZnO for Removal of Oil Spills and Dye Pollutants

*Jinfeng Wang<sup>a</sup>, Takuya Tsuzuki<sup>a,c\*</sup>, Bin Tang<sup>a</sup>, Lu Sun<sup>a</sup>, Xiujuan J. Dai<sup>a</sup>, Gayathri D.*

*Rajmohan<sup>a</sup>, Jingliang Li<sup>a</sup>, and Xungai Wang<sup>a,b\*</sup>*

<sup>a</sup>Institute for Frontier Materials, Deakin University, Geelong, Victoria, Australia 3217

<sup>b</sup>Ministry of Education Key Laboratory for Textile Fibers and Products, Wuhan Textile University, Wuhan, China

<sup>c</sup>Research School of Engineering, College of Engineering and Computer Science, Australian National University, Ian Ross Building 31, North Road, Canberra ACT 0200 Australia

\*CORRESPONDING AUTHORS:

Takuya Tsuzuki: Email: [takuya.tsuzuki@anu.edu.au](mailto:takuya.tsuzuki@anu.edu.au)

Xungai Wang: Email: [xungai.wang@deakin.edu.au](mailto:xungai.wang@deakin.edu.au)

### *Synthesis of PVP-capped ZnO nanoparticles*

Briefly, 0.27 g of zinc acetate was dissolved in ethanol and heated to 60 °C under constant stirring for 2 hours. Then, 0.5 g of PVP was added to the solution. A sodium hydroxide solution was prepared separately by dissolving 0.098 g of sodium hydroxide in 50 mL ethanol. The sodium hydroxide solution was added drop-wise into the zinc acetate solution. The solution mixture was then stirred continuously at 60 °C for up to 2 hours.

### *Preparation of GO dispersion*

Briefly, 10 g graphite flake and 7.5 g sodium nitrate were added to 300 mL of sulfuric acid (98%), and then 40 g of potassium permanganate was added in 1 hour. The mixture was stirred at room temperature for 3 days. Then 1 L of hydrogen peroxide solution (1% in water) was added into the mixture. Subsequently, the mixture was filtered and washed with deionized water. The resulting black cake was re-dispersed in de-ionized water to give a dark brown dispersion, which was subjected to dialysis for one week. The brown suspension was dried at 40 °C under vacuum. GO suspension was obtained by sonicating the as-prepared solid in water. The resulting homogenous brown dispersion was used for the assembly of GO@ZnO films.

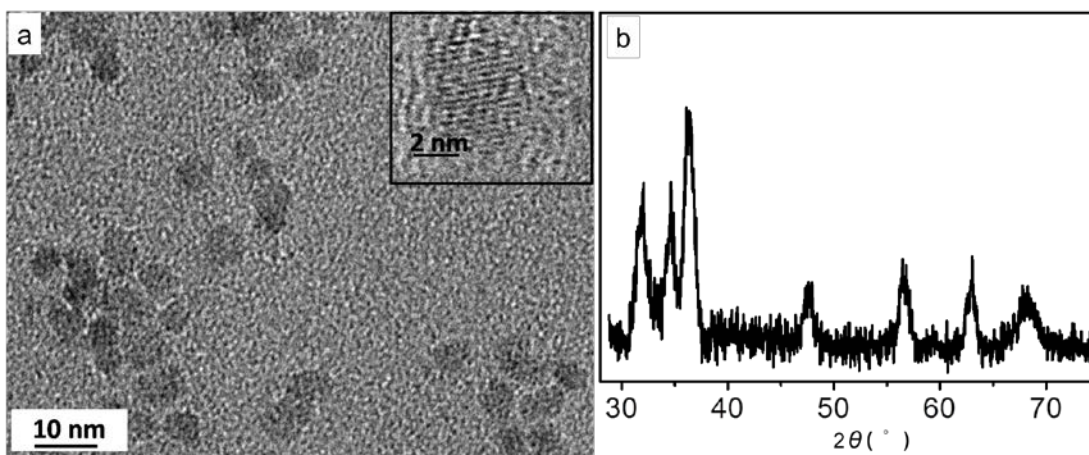


Fig. S1. (a) TEM image of PVP-capped ZnO nanoparticles. (b) XRD pattern of PVP-capped ZnO nanoparticles.

XRD spectra confirmed that the ZnO nanoparticles had the wurtzite-type crystal structure.

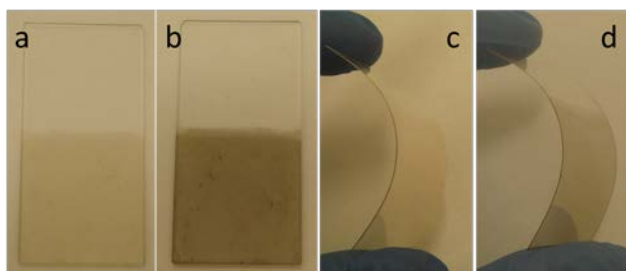


Fig. S2. Optical images of a  $(\text{GO@ZnO})_5$  multilayer film prepared on a quartz substrates (a) before and (b) after 3 hours of UV photoreduction; on a flexible PET substrate (c) before and (d) after 3 hours of UV photoreduction.

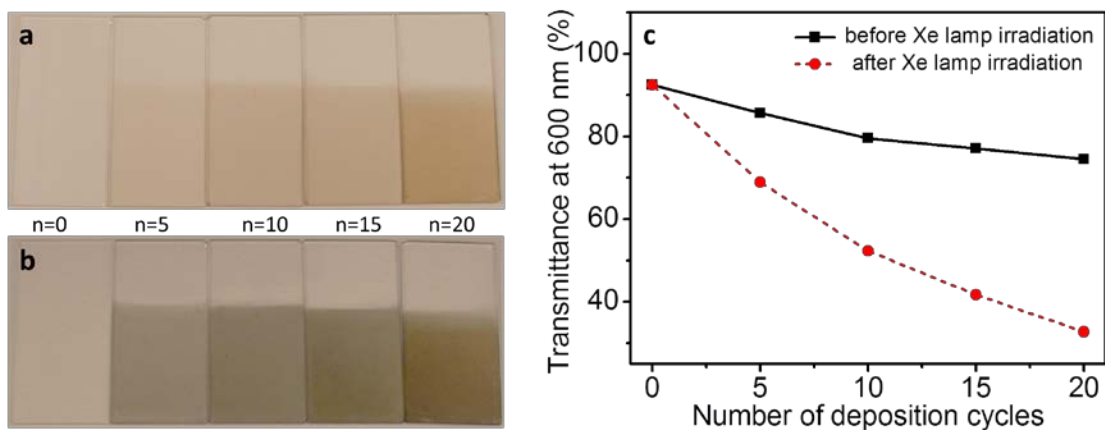


Fig. S3. Photographs of  $(\text{GO}@\text{ZnO})_n$  prepared on quartz slides with different numbers of layers: (a) before and (b) after the UV-induced photoreduction process for 3 hours. (c) Optical transmittance at 600 nm as a function of the number of layers before and after photoreduction for 3 hours.

After the photoreduction process, the colour of the slides darkened due to the formation of RGO as shown in Fig. S3b. Fig. S3c shows that the UV-vis transmittance of the hybrid films after photoreduction.

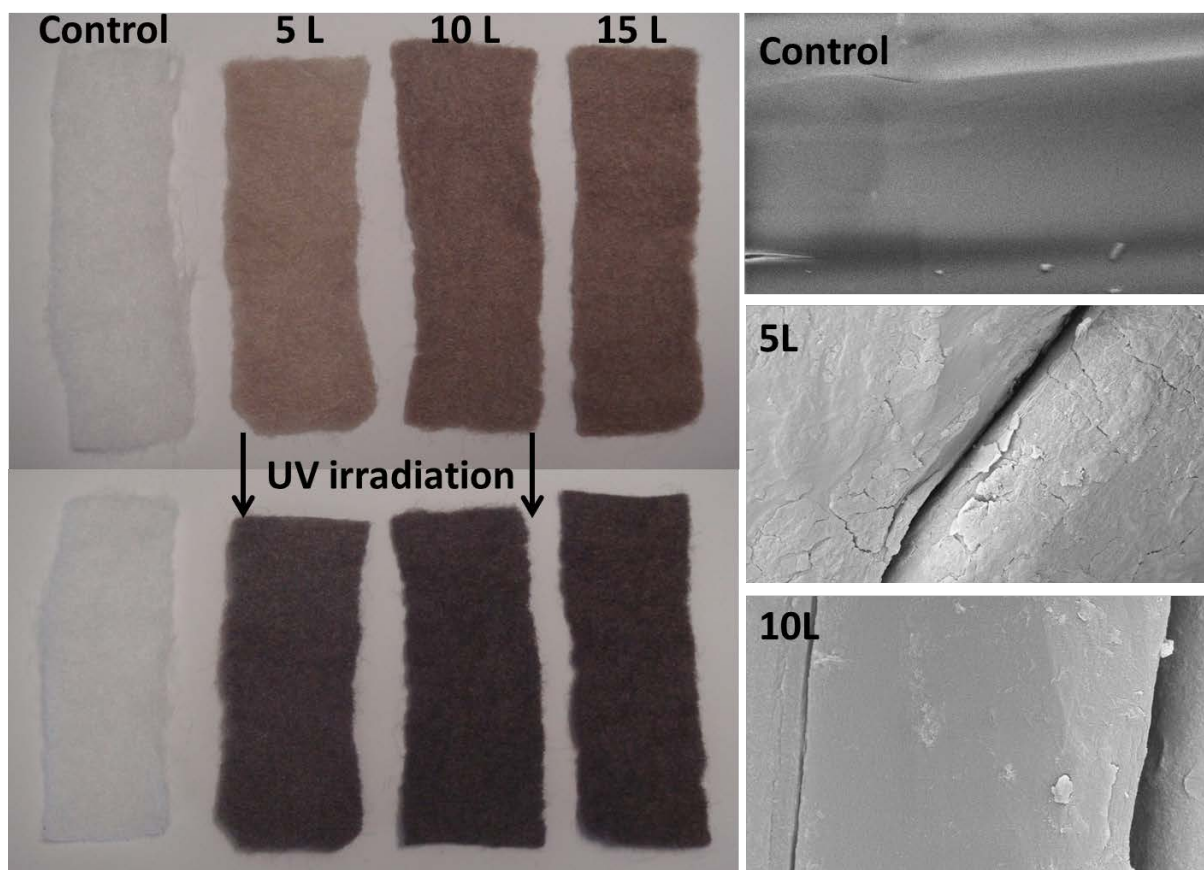


Fig. S4. Appearances of  $(\text{GO@ZnO})_n/\text{PET}$  fabrics ( $n=0, 5, 10$  and  $15$ ) before and after UV-photoreduction for 3 hours. SEM images of  $(\text{RGO@ZnO})_n$  coated on PET fabrics and PET single fibre with  $n=0, 5$  and  $10$ .

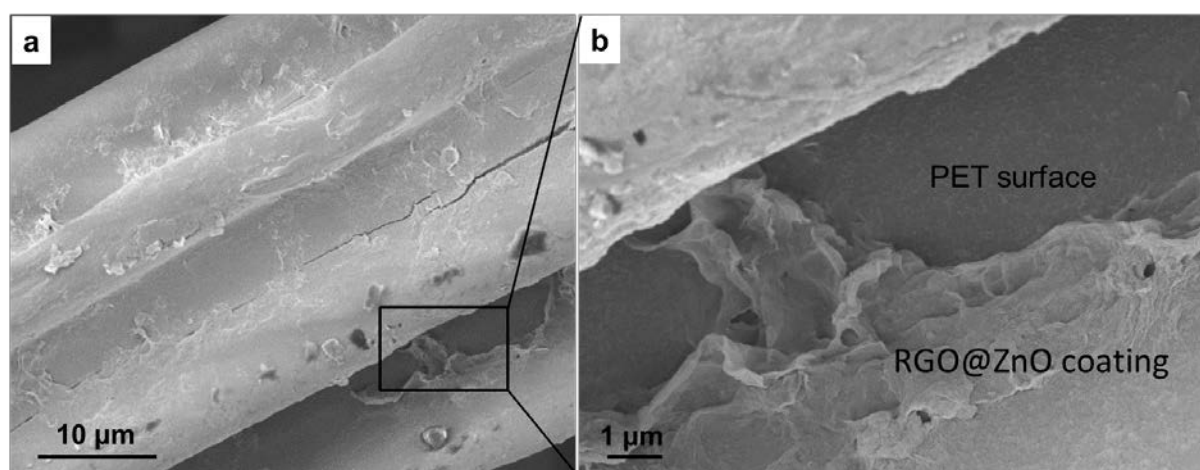


Fig. S5. SEM images of  $(\text{GO@ZnO})_{15}/\text{PET}$  fabrics.

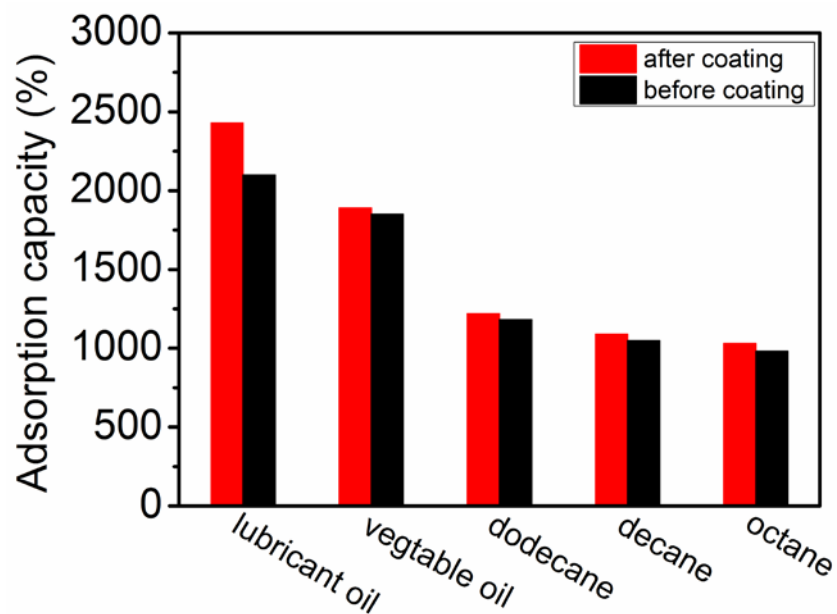


Fig. S6. Adsorption capacity of PET fabric before and after coating with RGO@ZnO in terms of weight gain.

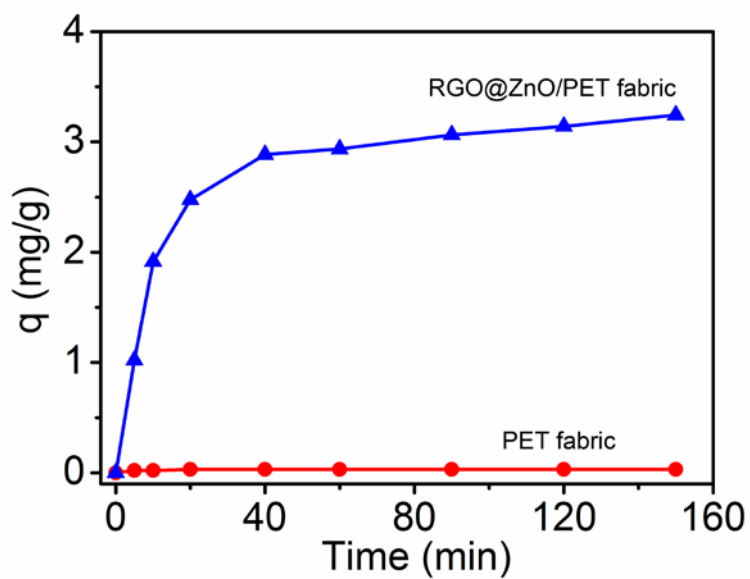


Fig. S7. Dye adsorption kinetics of RhB on RGO@ZnO/PET fabric.  $C(\text{RhB})_{\text{initial}} = 12 \text{ ppm}$   
 $T = 293 \text{ K}$

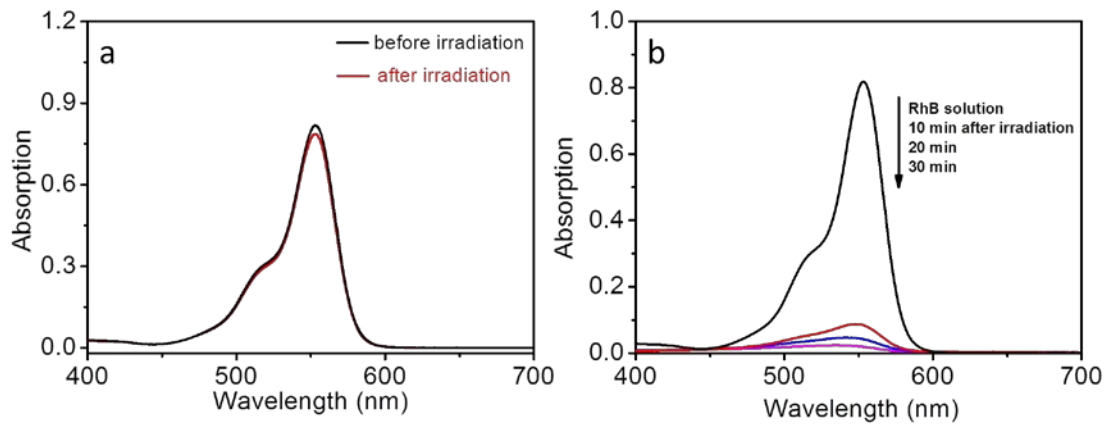


Fig. S8. (a) UV-vis spectra of RhB solution before and after simulated sunlight irradiation for 30 min without (RGO@ZnO)<sub>10</sub>/PET fabric. (b) The UV-vis spectra of the original RhB solution and the RhB solution after simulated sunlight irradiation for different times with the presence of (RGO@ZnO)<sub>10</sub>/PET fabric.