Electronic Supplementary Information (ESI)

Graphene Oxide as a Promising Photocatalyst for CO\textsubscript{2} to Methanol Conversion

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**Figure S1.** Schematic diagram of the photocatalytic reduction of CO\textsubscript{2} with graphene oxide.
Figure S2. Wide-scan XPS spectra of graphene oxide samples (GO-1, GO-2 and GO-3).
**Electrochemical determination of the conduction band potential:**

The conduction band position was estimated by cyclic voltammetry (CV) conducted by the cast GO films on a glassy carbon (GC) as working electrode in dry acetonitrile containing 0.1M TBAP (tetrabutylammonium tetrafluroborate) as an electrolyte under nitrogen atmosphere. The typical cyclic voltammetry for GO is shown in Figure S3. The lowest unoccupied molecular orbital (LUMO) level of the GO was determined empirically from the reduction onset potential ($E_{\text{red}}$). The reduction onset potential was determined from the intersection of the two tangents drown at the current rise and background charging current of the CV. The reduction onset potential has been calculated as -0.79V vs NHE.

![Cyclic voltammograms of glassy carbon and reduction onset potential of GO film casted onto a GC electrode in acetonitrile containing 0.1 M TBAP (tetrabutylammonium tetrafluroborate). Scan rate = 100 mV/s. (Counter electrode: Pt )](image)

**Figure S3.** Cyclic voltammograms of glassy carbon and reduction onset potential of GO film casted onto a GC electrode in acetonitrile containing 0.1 M TBAP (tetrabutylammonium tetrafluroborate). Scan rate = 100 mV/s. (Counter electrode: Pt )
**Figure S4.** XPS spectra (C1s) with deconvoluted peaks of graphene oxide samples (GO-1, GO-2 and GO-3) after photocatalytic reaction. Peaks 1 to 3 represents C=C (or sp²), C-O and >C=O components, respectively. Relative areal intensity of –C-O and >C=O normalized with sp² components.

**Reference:**