Electronic Supplementary Information (ESI)

Graphene Oxide as a Promising Photocatalyst for CO_2 to Methanol Conversion

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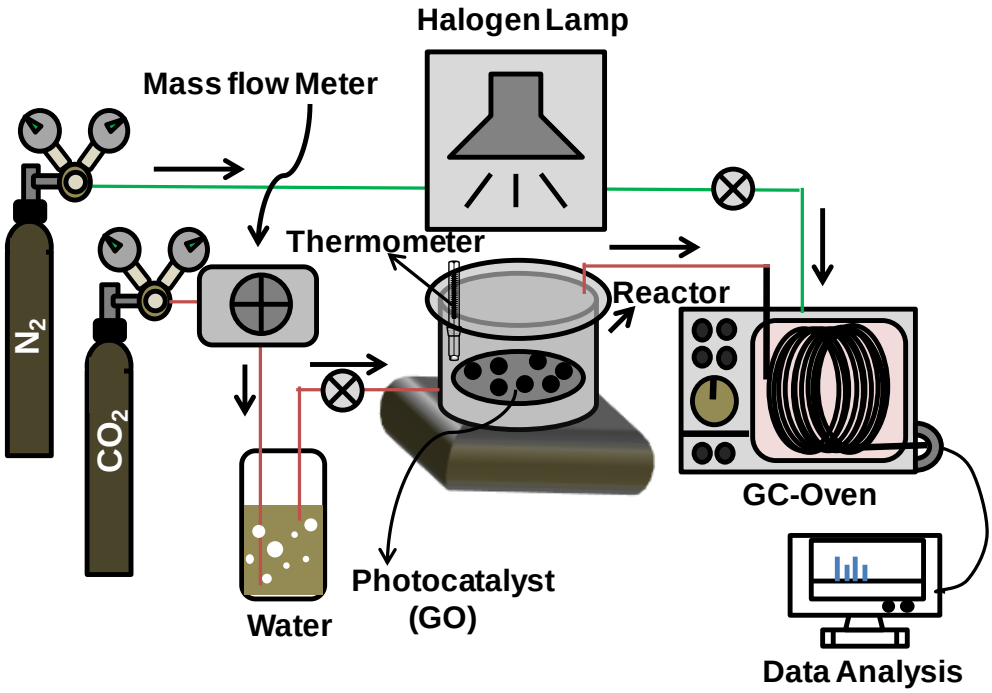

Figure S1. Schematic diagram of the photocatalytic reduction of CO_2 with graphene oxide.

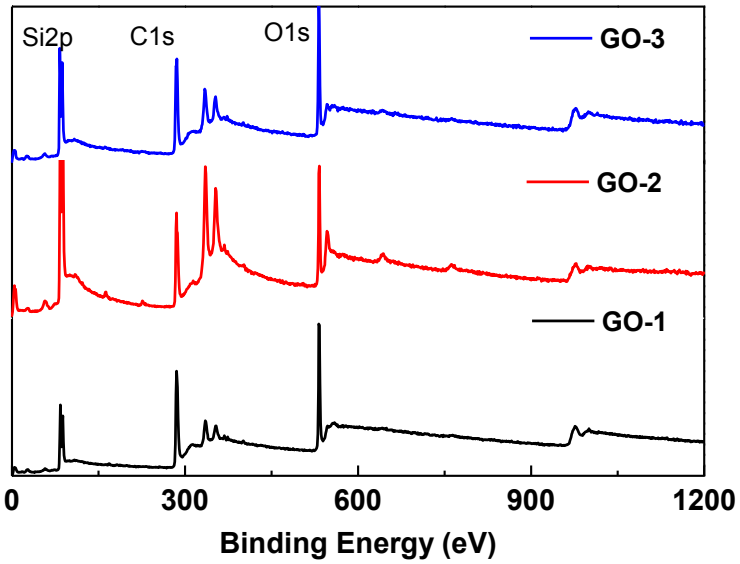

Figure S2. Wide-scan XPS spectra of graphene oxide samples (GO-1, GO-2 and GO-3).

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_{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.[1] The reduction onset potential has been calculated as -0.79V vs NHE.

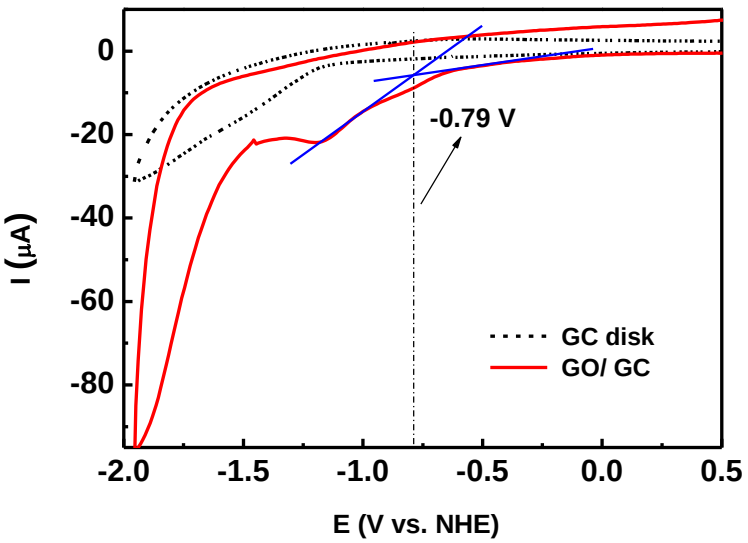

Figure S3. Cyclic voltammograms of glassy carbon and reduction onset potential of GO film casted onto a GC electrode in acetonitrile containing 0.1 M TBAP (tetrabutylammonium tetrafluroborate). Scan rate = 100 mV/s. (Counter electrode: Pt)

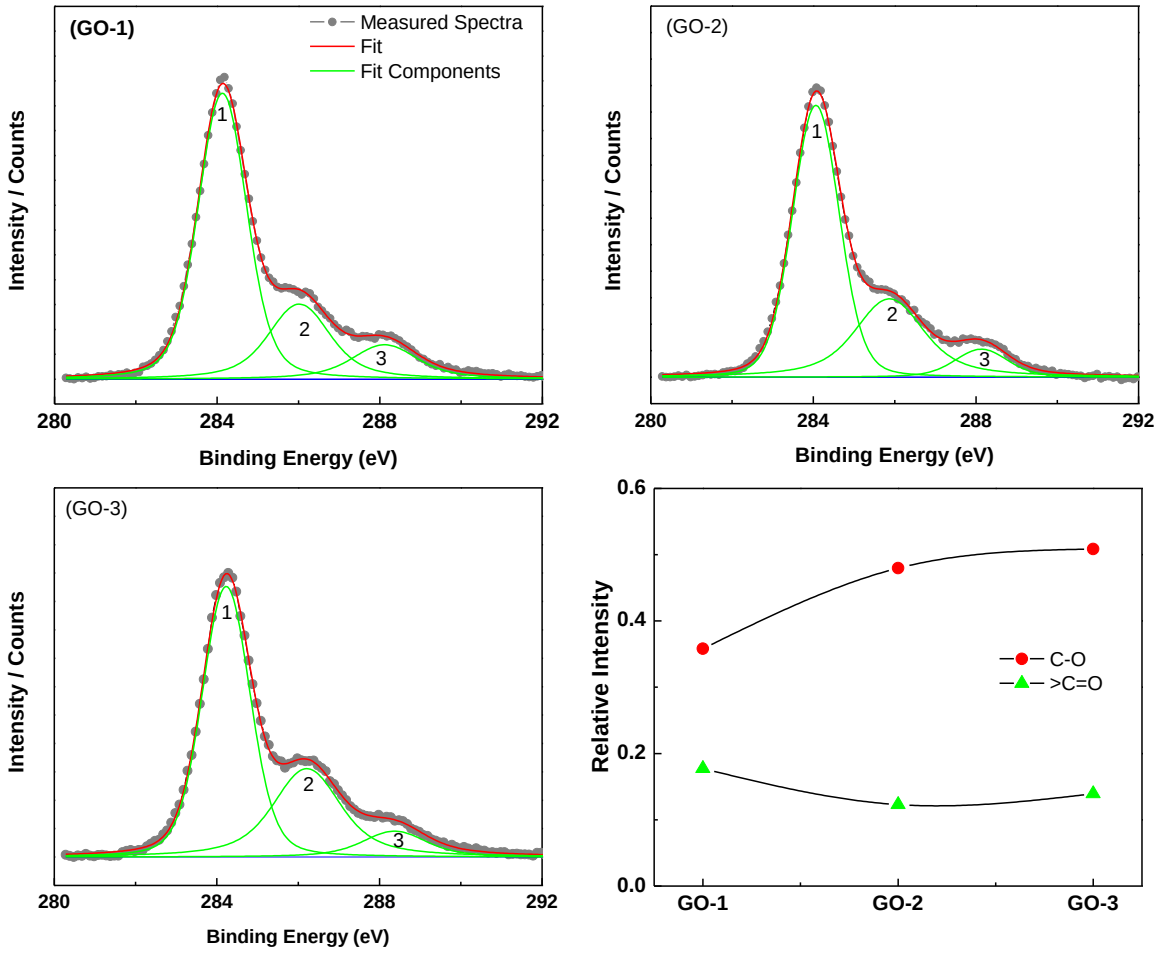

Figure S4. XPS spectra (C1s) with deconvoluted peaks of graphene oxide samples (GO-1, GO-2 and GO-3) after photocatalytic reaction. Peaks 1 to 3 represents C=C (or sp2), C-O and >C=O components, respectively. Relative areal intensity of –C-O and >C=O normalized with sp^2 components.

Reference:

1 W. Alhalash and R. Holze, *J. Solid State Electrochem.*, 2007, **11**, 1605.