Supporting Information

Porous Organic Polymer (POP) Nanosheets: An Efficient Photo-catalyst for Visible-light Assisted CO_2 Reduction

Surya Das[a], Ipsita Hazra Chowdhury[a], Adwitiya Chakraborty[b], Milan Kanti Naskar[b], Mitali Sarkar[a] and Sk. Manirul Islam*[a]

[a] Department of Chemistry, University of Kalyani, Kalyani, Nadia, West Bengal, India, Email: manir65@rediffmail.com

[b] Advanced Ceramics & Composites Division, CSIR-Central Glass and Ceramic Research Institute, Kolkata 700 032, India

---

Contents

Materials

4,4'- biphenyldicarbaldehyde (PCA) and ortho-tolidine (TOL) were obtained from TCI chemicals, India and alfa aesar respectively and used without further purification. Para-toluenesulfonic acid (PTSA) werepurchased from sigma Aldrich, India. Triethanolamine (TEOA) and nickel chloride were received from E-Merk, India. All other reagents such as Acetone and Acetonitrile used as solvents were bought from E-Merk, India and were used as received. All the reactions were performed using oven-dried glassware under ambient atmosphere unless otherwise mentioned.

Instrumentation

Absorption Spectroscopy: UV-Vis absorption spectra of the catalyst was recorded on SHIMADZU, UV-1900I UV-Vis spectrometer with a standard 1 cm x 1 cm cuvette

NMR Spectra: ^{1}H Proton nuclear magnetic resonance spectra were recorded on a Bruker 400 MHz spectrometer. Chemical shifts for protons are reported in parts per million (ppm).

PXRD: The PXRD analysis was performed by using an X-ray diffractometer (Philips X'Pert Pro PW 3050/60) equipped with Ni-filtered Cu Kα (λ= 0.15418 nm) radiation.

IR Spectra: The FTIR spectra of the materials were recorded from a Perkin-Elmer spectro-photometer (FT-IR 783) on KBr pellets.

BET: The N_2 adsorption-desorption analysis of PCA-TOL COF sample was conducted by using a BET Surface Analyzer [Quantachrome (ASIQ MP)].

Solid State UV:The Solid-state UV analysis was conducted by using the instrument-PerkinElmer Lambda 900.

SEM: FESEM images of the catalyst were acquired by using Scanning Electron Microscope (SEM) [Zeiss, Supra™ 35VP, Oberkochen, Germany].

TEM: Transmission Electron Microscope (TEM) [JEOL JEM 2100] was used obtain the morphological information of the sample.

XPS: The XPS analysis was conducted by using the instrument: Thermo Fisher Scientific Pvt. Ltd.,UK; model:ESCALAB Xi+.

TGA: The thermal stability of the COF material was analysed by a Thermogravimetric Analyzer [NETZSCH STA 449C, Germany].

Reaction set-up:

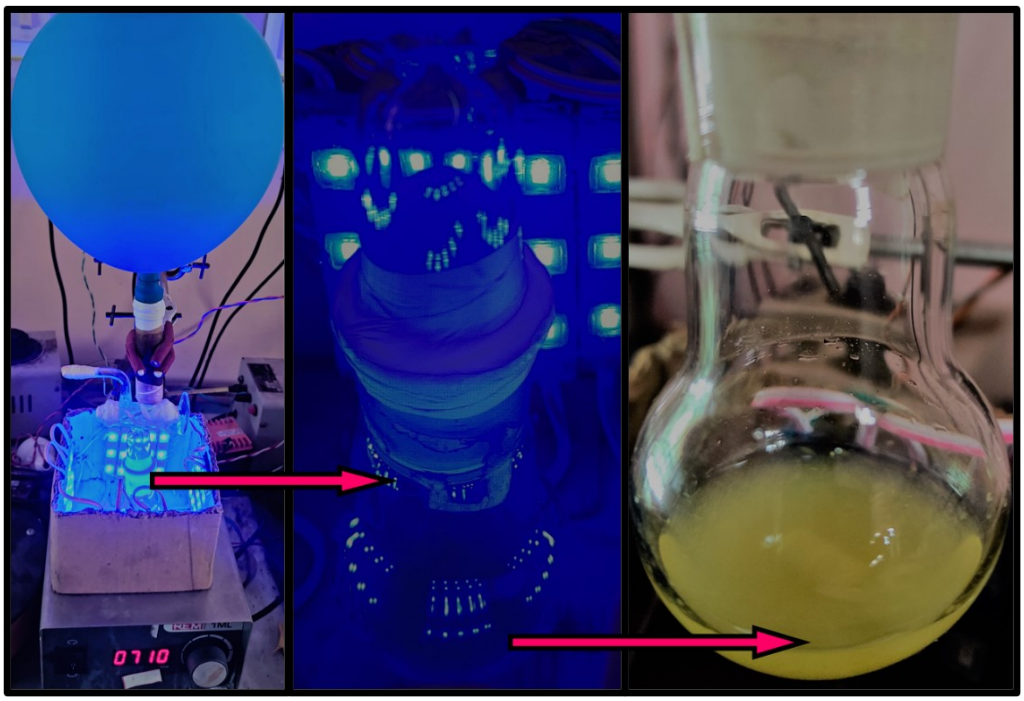

Figure S1. Photo of the photoreaction setup with CO_2 balloon directly irradiated with the 445 nm LED.

Calculation of TON:

TON = No. moles of HCOOH or HCHO formed/no. moles of Co-catalyst used

Calculation of product's yields:

Reaction yields were calculated using calibration plot as shown **Figure S2**. Known concentration of HCOOH and HCHO were plotted with the O.D. value in UV-visspectra to obtain it.

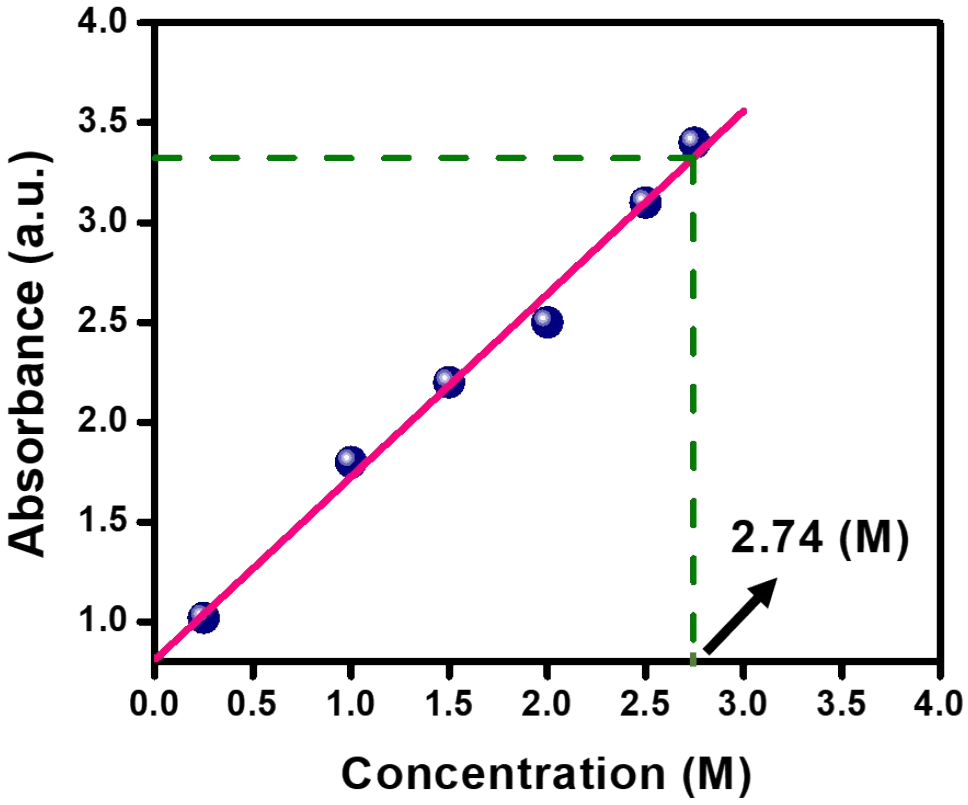

Figure S2. Calibration curve of formic acid for determination of concentration of Formic acid produced.

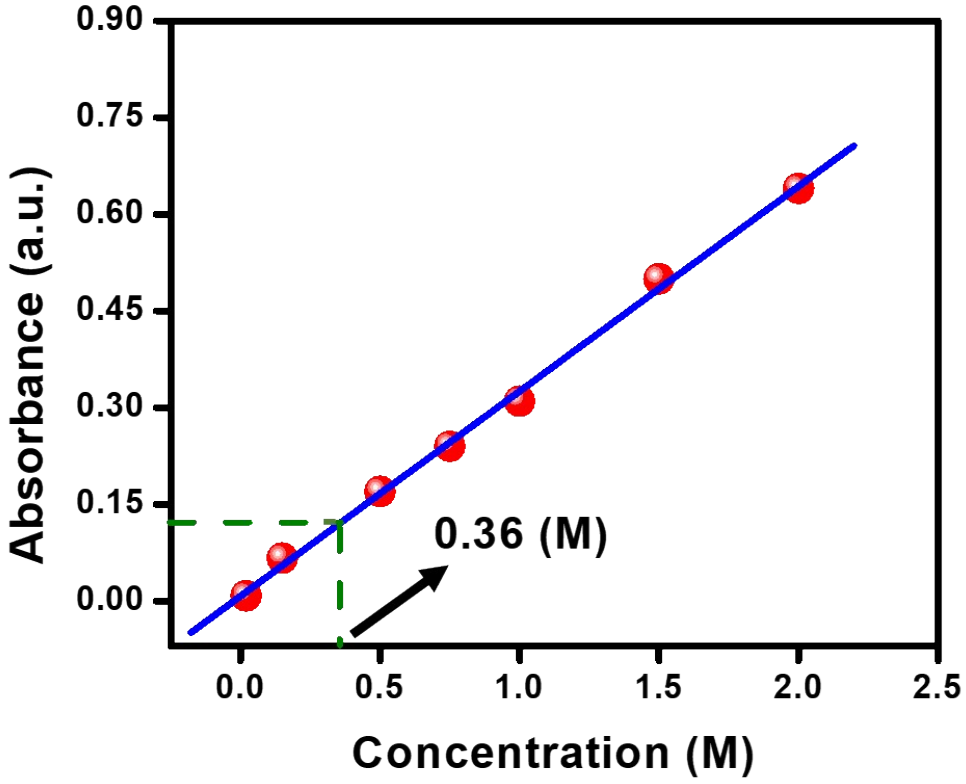

Figure S3. Calibration curve of formaldehyde for determination of concentration of Formaldehyde produced.

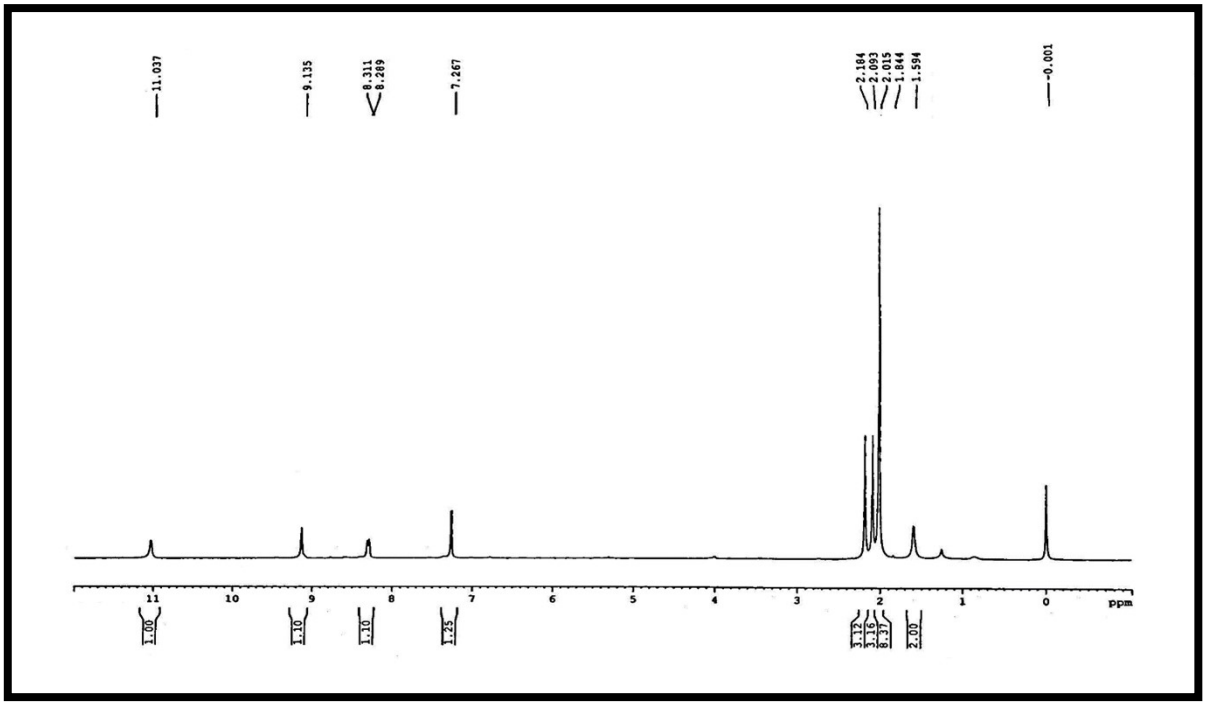

Figure S4. ^{1}H-NMR spectra of products.

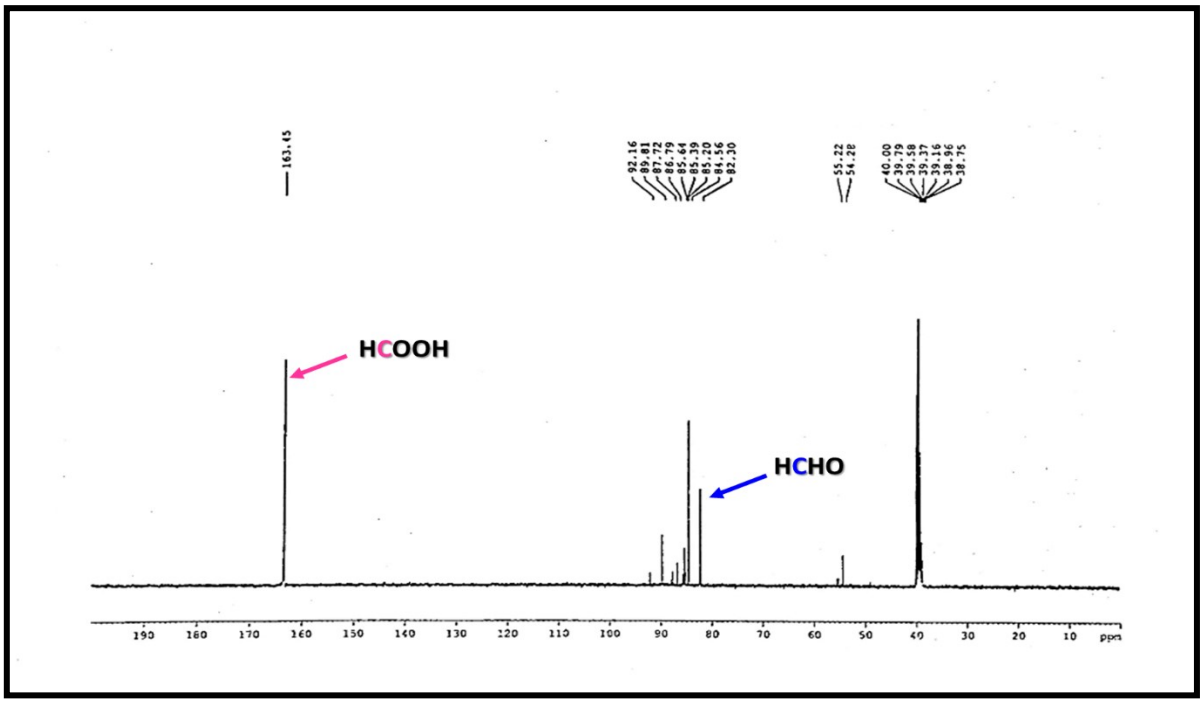

Figure S5. ^{13}C-NMR spectra of products.

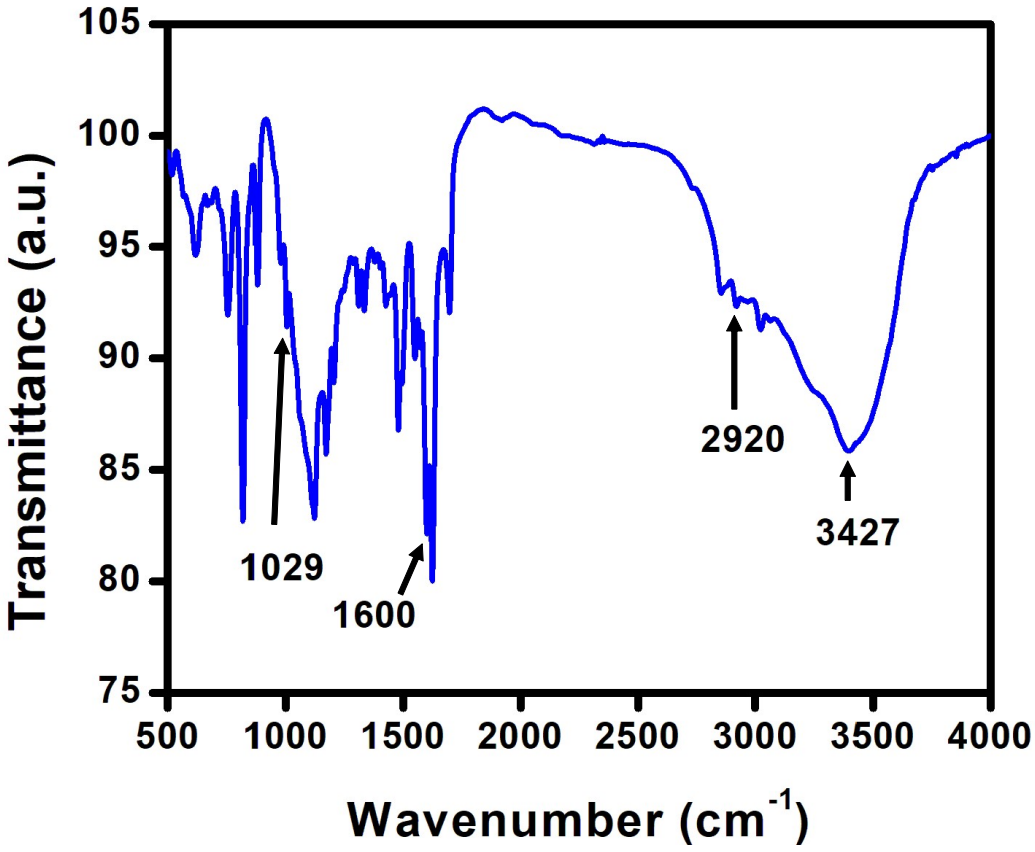

Figure S6. FTIR spectra of recycled catalyst.

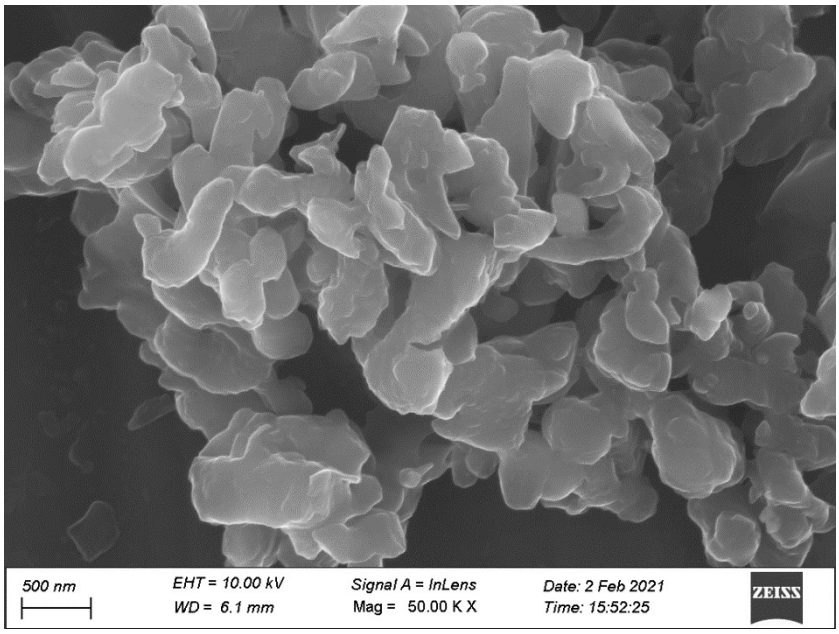

Figure S7. FESEM image of recycled catalyst.