Supporting Figure Captions

Figure S1. STEM-EDS spectrum with EDS mapping of Cu, Nb and O elements for 1wt% Cu/r-Nb_2O_5 sample.

Figure S2. STEM-EDS spectrum with EDS mapping of Cu, Nb and O elements for 3wt% Cu/r-Nb_2O_5 sample.

Figure S3. STEM-EDS spectrum with EDS mapping of Cu, Nb and O elements for 5wt% Cu/r-Nb_2O_5 sample.

Figure S4. BET surface area of (A) pure Nb_2O_5, (B) r-Nb_2O_5 and (C) 2wt% Cu/r-Nb_2O_5 nanosheets.

Figure S5. The amount of photocatalytic products (H_2, CO & CH_4) evolved during CO_2 reduction for of pure Nb_2O_5, r-Nb_2O_5, 1wt% Cu/r-Nb_2O_5, 2wt% Cu/r-Nb_2O_5, 3wt% Cu/r-Nb_2O_5, 5wt% Cu/r-Nb_2O_5 and 2wt% Cu/Nb_2O_5 nanosheets.

Figure S6. Summary of Mott-Schottky results with flat band potential and charge carrier density.

Table TS1. Atomic weight% of Cu, Nb and O elements obtained from STEM-EDS analysis.

Table TS2. The obtained CO_2 selectivity for Nb_2O_5, reduced Nb_2O_5, 1wt% Cu/r-Nb_2O_5, 2wt% Cu/r-Nb_2O_5, 3wt% Cu/r-Nb_2O_5, 5wt% Cu/r-Nb_2O_5 and 2wt% Cu/Nb_2O_5 nanosheets.

Table TS3. Photocatalytic CO_2 reduction performance of present nanostructures compared to the Vanadate based photocatalyst with the reported photocatalysts.

Table TS4. Results obtained after CO_2 reduction tests for 10 consecutive cycles.

Table TS5. Summary of TRPL results for pure Nb_2O_5, r-Nb_2O_5 and 2wt% Cu/r-Nb_2O_5 nanosheets.

Formula for charge carrier density (N_D)

$$N_D = (2/e_0\varepsilon\varepsilon_0)/[d(1/C^2)/dV]$$

where e_0=electron charge, ε = dielectric constant of Nb_2O_5 (77) and V = applied potential

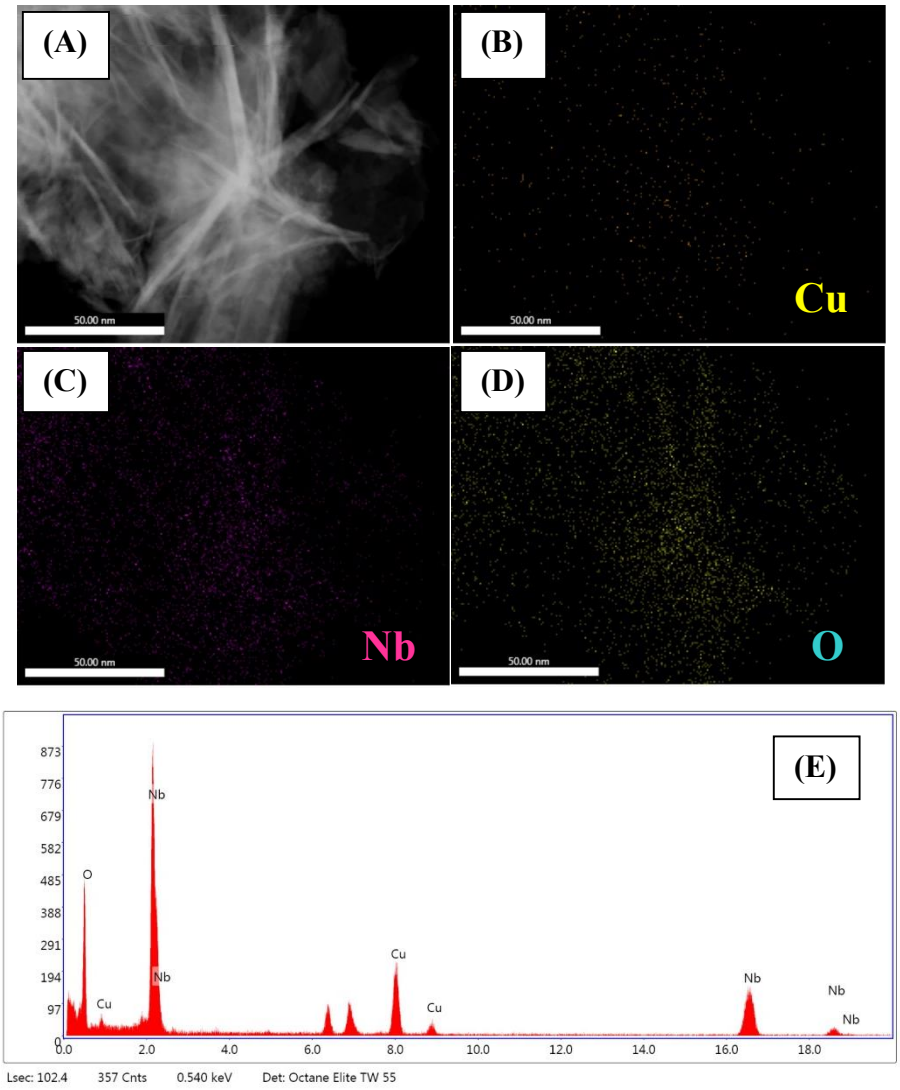
(A)
(B)
Cu
(C)
Nb
(D)
O
50.00 nm
(E)
873
776
679
582
485
388
291
194
97
0
O
Nb
Cu
Nb
Cu
Cu
Nb
Nb
Nb
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Lsec: 102.4
357 Cnts
0.540 keV
Det: Octane Elite TW 55

Figure S1

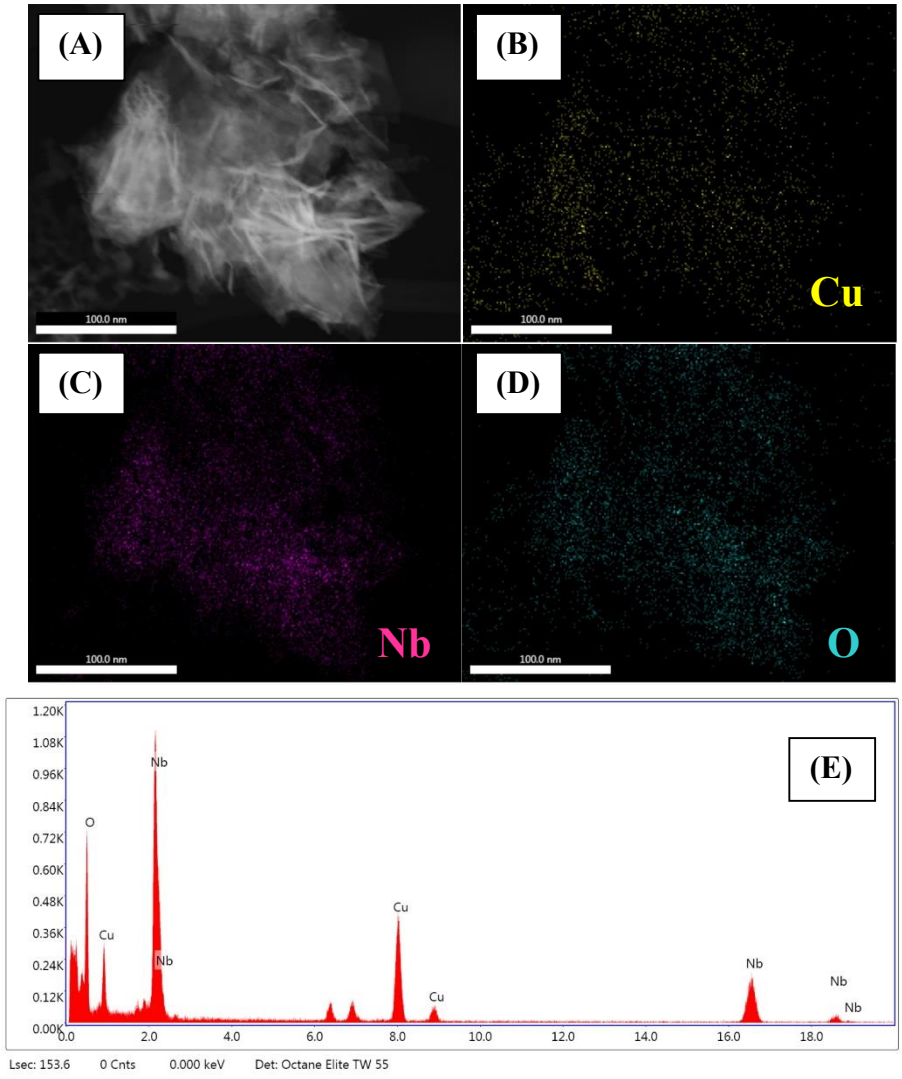
(A)
100.0 nm
(B)
Cu
100.0 nm
(C)
Nb
100.0 nm
(D)
O
100.0 nm
(E)
1.20K
1.08K
0.96K
0.84K
0.72K
0.60K
0.48K
0.36K
0.24K
0.12K
0.00K
O
Cu
Nb
Nb
Cu
Cu
Nb
Nb
Nb
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Lsec: 153.6
0 Cnts
0.000 keV
Det: Octane Elite TW 55

Figure S2

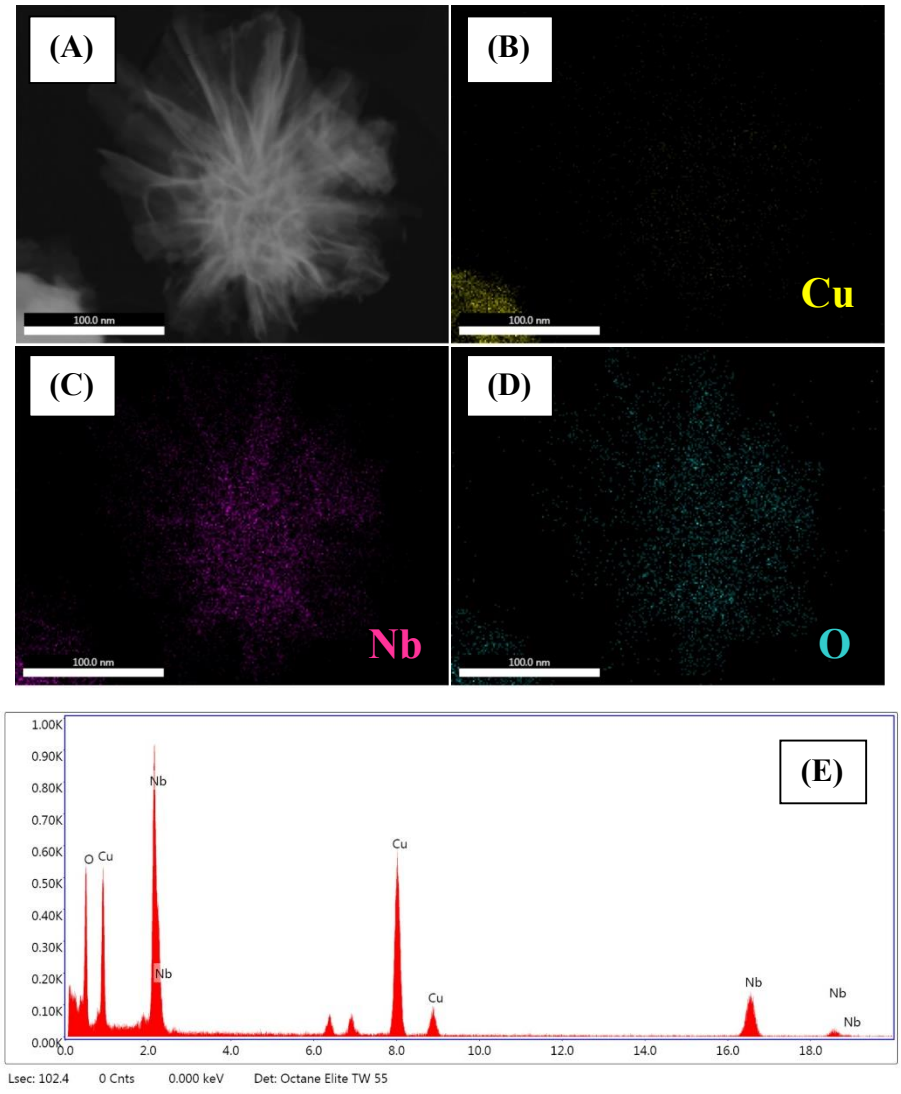
(A)
(B)
Cu
(C)
Nb
(D)
O
100.0 nm
(E)
O
Cu
Nb
Cu
Nb
Cu
Nb
Nb
Nb
1.00K
0.90K
0.80K
0.70K
0.60K
0.50K
0.40K
0.30K
0.20K
0.10K
0.00K
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
Lsec: 102.4
0 Cnts
0.000 keV
Det: Octane Elite TW 55

Figure S3

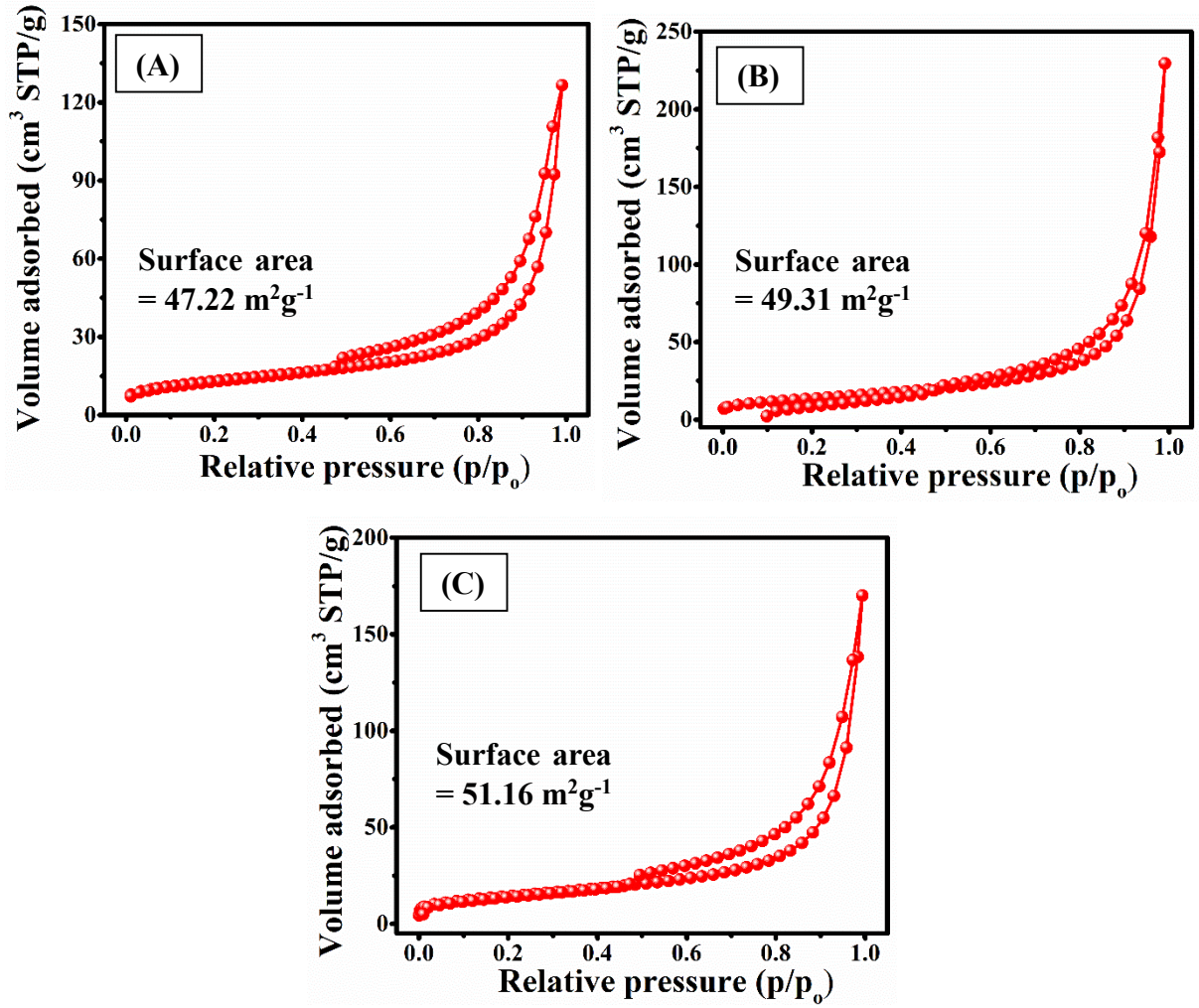

Figure S4(A to C)

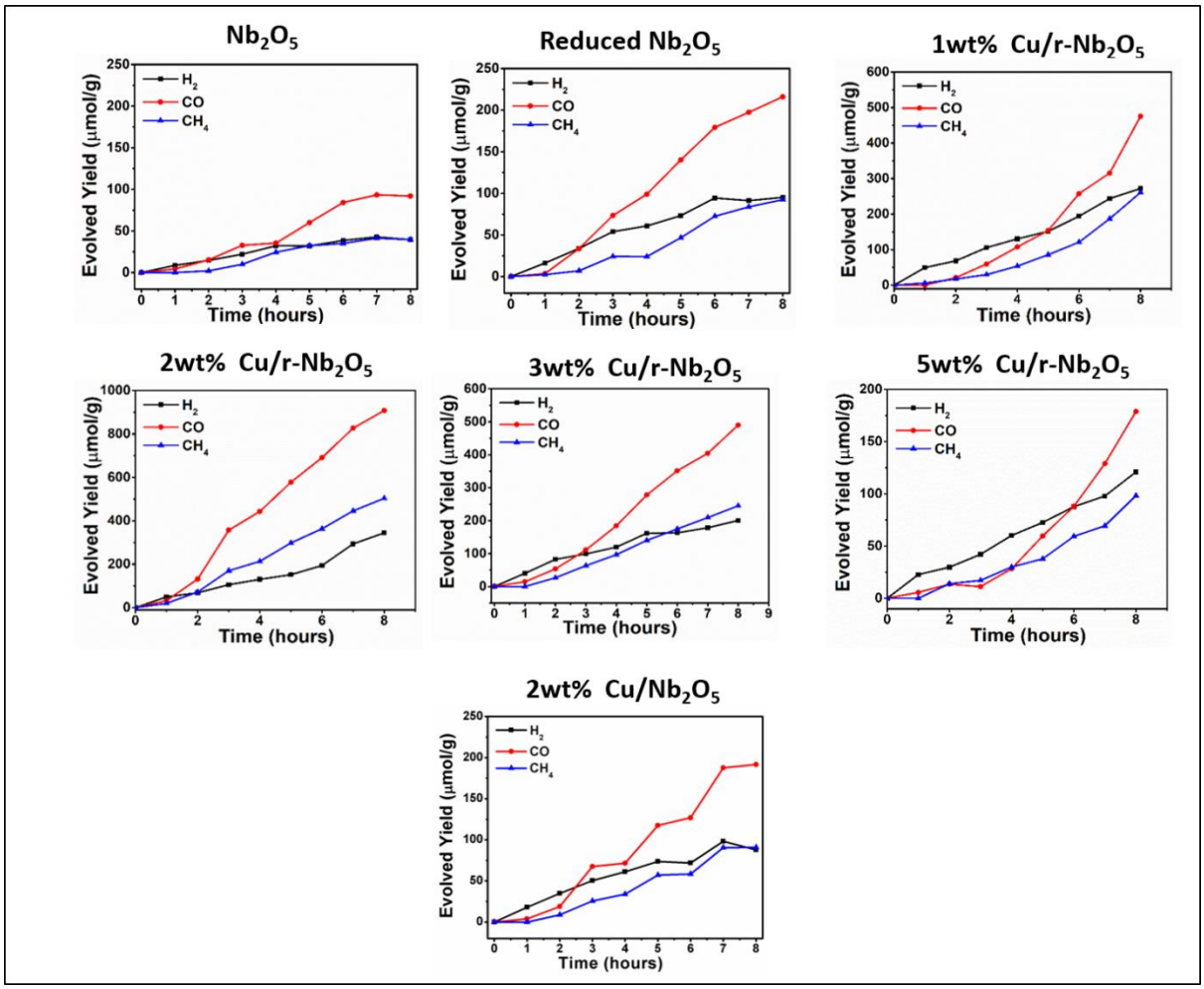
Nb2O5
Reduced Nb2O5
1wt% Cu/r-Nb2O5
2wt% Cu/r-Nb2O5
3wt% Cu/r-Nb2O5
5wt% Cu/r-Nb2O5
2wt% Cu/Nb2O5
H2
CO
CH4
Evolved Yield (μmol/g)
Time (hours)

Figure S5

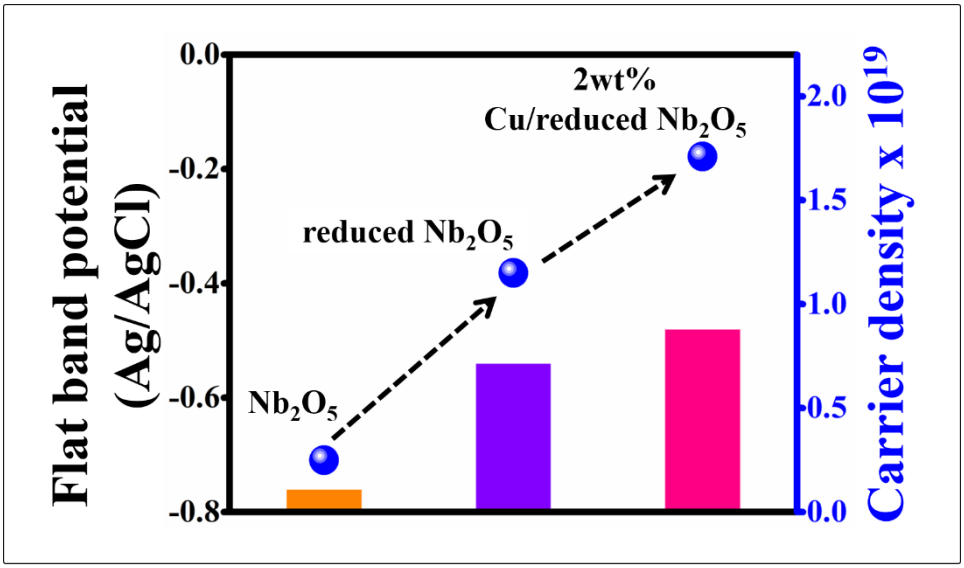
Flat band potential
(Ag/AgCl)
0.0
-0.2
-0.4
-0.6
-0.8
2wt%
Cu/reduced Nb2O5
reduced Nb2O5
Nb2O5
2.0
1.5
1.0
0.5
0.0
Carrier density x 10^19

Figure S6

Sample Name	Cu (Atomic %)	Nb (Atomic %)	O (Atomic %)
Nb_2O_5	-	55.39	44.61
r-Nb_2O_5	-	73.57	26.43
1wt% Cu/r-Nb_2O_5	0.94	56.29	42.77
2wt% Cu/r-Nb_2O_5	1.75	58.85	39.40
3wt% Cu/r-Nb_2O_5	6.62	49.03	44.35
5wt% Cu/r-Nb_2O_5	15.93	46.57	37.50

Table TS1

Sr. No.	Sample Name	H_2 (mmol/g)	CO (mmol/g)	CH_4 (mmol/g)	Selectivity (%) S_{CO2}
1	Nb_2O_5	0.039	0.092	0.039	86
2	r-Nb_2O_5	0.095	0.216	0.092	86
3	1wt% Cu/r-Nb_2O_5	0.272	0.475	0.261	85
4	2wt% Cu/r-Nb_2O_5	0.344	0.908	0.504	89
5	3wt% Cu/r-Nb_2O_5	0.201	0.490	0.245	88
6	5wt% Cu/r-Nb_2O_5	0.121	0.179	0.098	83
7	2wt% Cu/Nb_2O_5	0.087	0.0192	0.091	86

Table TS2

Sr. No.	Catalyst Name	Products (mmol g^{-1})	Experimental details	Reference no.
1	0.51wt% Cu/Nb_2O_5	CO: 0.199, CH_4: 0.419	Catalyst amount: 0.1g, 6 UV lamps of 15 W	30
2	$Nb_2O_5/g\text{-}C_3N_4$	CO: 0.343, CH_4: 0.041	Catalyst amount: 0.03g 300 W Xe lamp	34
3	$SiO_2{-}HNb_3O_8$	CH_4: 0.004	Catalyst amount: 0.1g, 0.4 wt % Pt 350 W Xe lamp, 34.8 mW cm^{-2}	56
4	$g\text{-}C_3N_4/NaNbO_3$	CH_4: 0.024	Catalyst amount: 0.05g + 0.5 wt % Pt 300-W Xe lamp, UV cutoff filter ($\lambda > 420$ nm).	57
5	10wt% Cu/Nb_2O_5	CH_4: 0.048, HCOOH: 0.074 CH_3COOH: 0.007	Catalyst amount: 0.3g UVC lamp (OSRAM 11 W) 21.49 mW·cm^{-2}	58
6	Nb_2O_5 nanofibers	CO: 0.008, CH_4: 0.005	Sample glass slide (2x2 cm) 18 W mercury lamp, 254 nm	59
7	$Bi_2O_2(OH)(NO_3)/Nb_2O_5$	CO: 0.016, C_2H_4: 0.006	UV-C irradiation (Philips 18 W mercury)	60
8	Nb_2O_5	H_2:0.039; CO:0.092; CH_4:0.039	Nanostructure grown on FTO substrate (4 cm x 2 cm) 300 W Xenon lamp	**Present work**
	r-Nb_2O_5	H_2:0.095; CO:0.216; CH_4:0.092		
	2wt% Cu/r-Nb_2O_5	H_2:0.344; CO:0.908; CH_4:0.503		

Table TS3

Cycle number	H_2 (mmol/g)	CO (mmol/g)	CH_4 (mmol/g)	Selectivity (%) S_{CO2}
1	0.344	0.908	0.504	89
2	0.374	0.930	0.493	88
3	0.314	0.938	0.460	89
4	0.330	0.910	0.405	88
5	0.287	0.923	0.422	90
6	0.389	0.968	0.425	87
7	0.371	0.938	0.506	89
8	0.321	0.909	0.480	89
9	0.290	0.799	0.481	90
10	0.256	0.622	0.313	88

Table TS4

Sample Name	τ1	τ2	B1	B2	Average carrier life time τ (ns)
Nb_2O_5	0.10	0.35	11	3.9	0.23
r-Nb_2O_5	0.14	0.41	12	3.3	0.26
2wt% Cu/r-Nb_2O_5	0.29	3	9.7	1.1	1.75

Table TS5