Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Biosynthesized Silver Nanoring as A Highly Efficient and Selective Electrocatalyst for CO_2 Reduction Reaction

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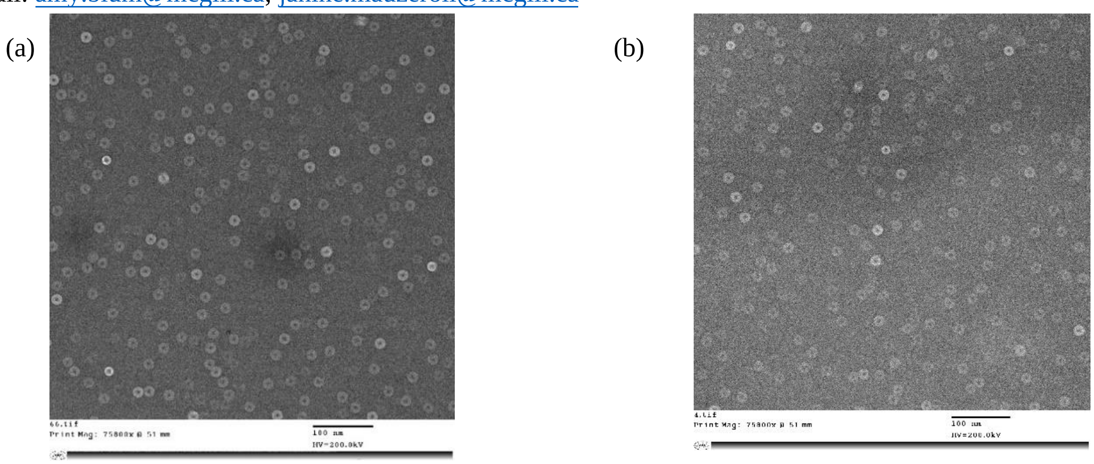

Figure S1. TEM image of the wild type TMV-cp in water before (a) and after (b) UV illumination, the dominant species is in disk form.

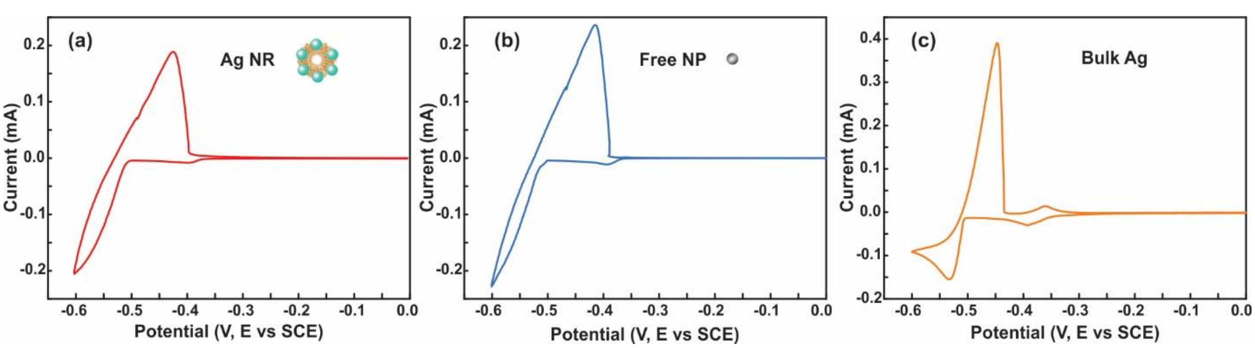

Figure S2. Cyclic voltammograms of UPD and bulk deposition of lead in 5 mM $Pb(NO_3)_2$, 10 mM HNO_3 and 10 mM KCl, with a scan rate of 10 mV/s.

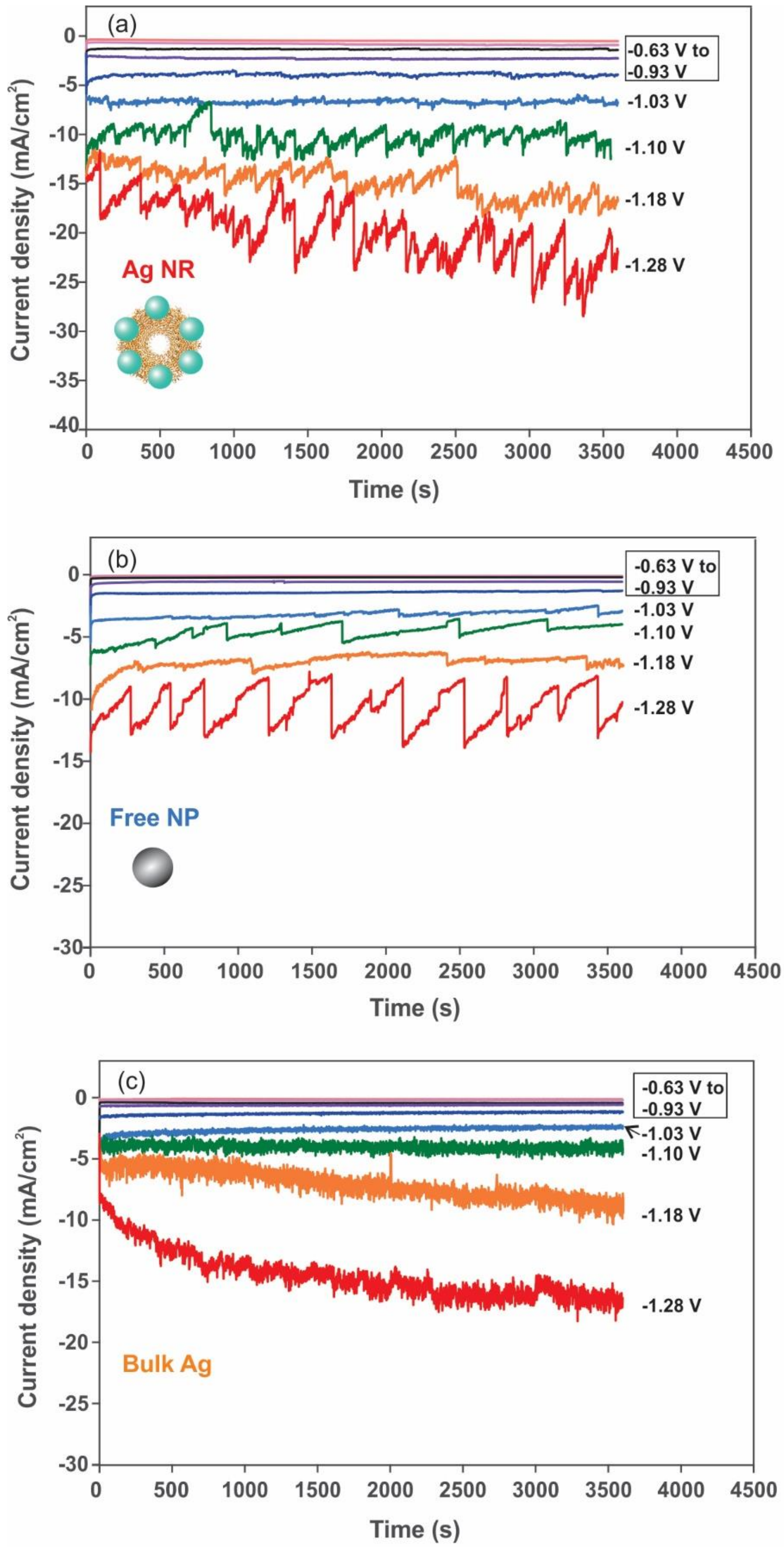

Figure S3. Current densities over time at different applied potentials of Ag NR (a); Free NP (b); and bulk Ag (c).

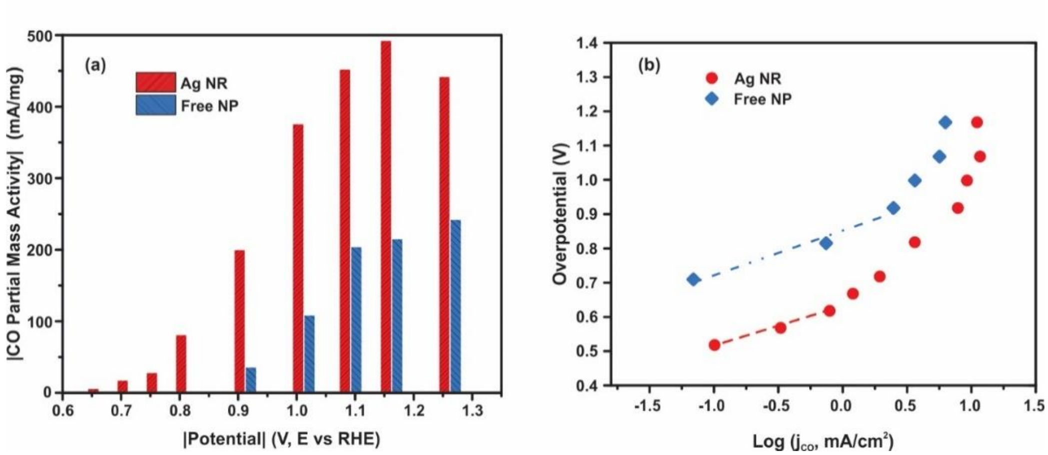

Figure S4. CO mass activity of Ag NR and Free NP under different applied potentials (a); Tafel plots of prepared Ag NR and Free N

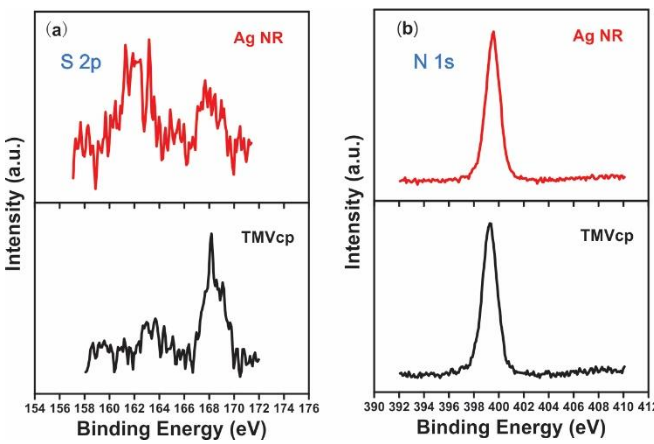

Figure S5. XPS spectra of S 2p (a) and N 1s (b) from Ag NR and pure TMVcp.

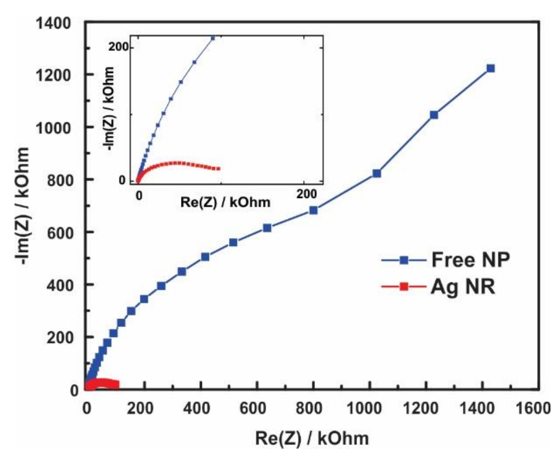

Figure S6. Nyquist plot of Ag NR and Free NP recorded at open circuit potential in CO_2 saturated 0.5 M $KHCO_3$ solution.

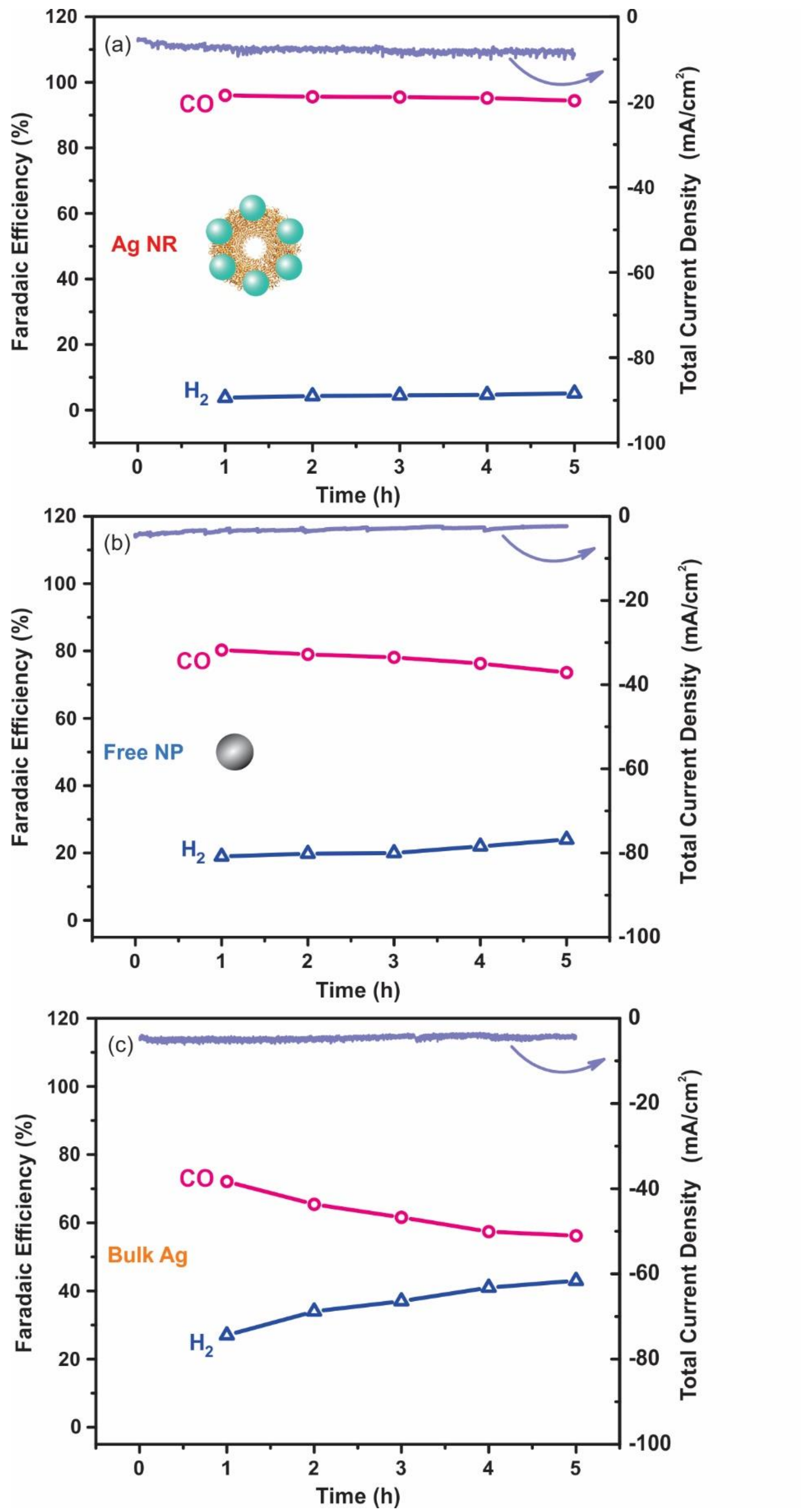

Figure S7. Five hours durability test at a potential of -1.028 V from Ag NR (a); Free NP (b); and Bulk Ag (c). FEs of CO and H_2 (left axis) versus time and total current densities (right axis) versus time.

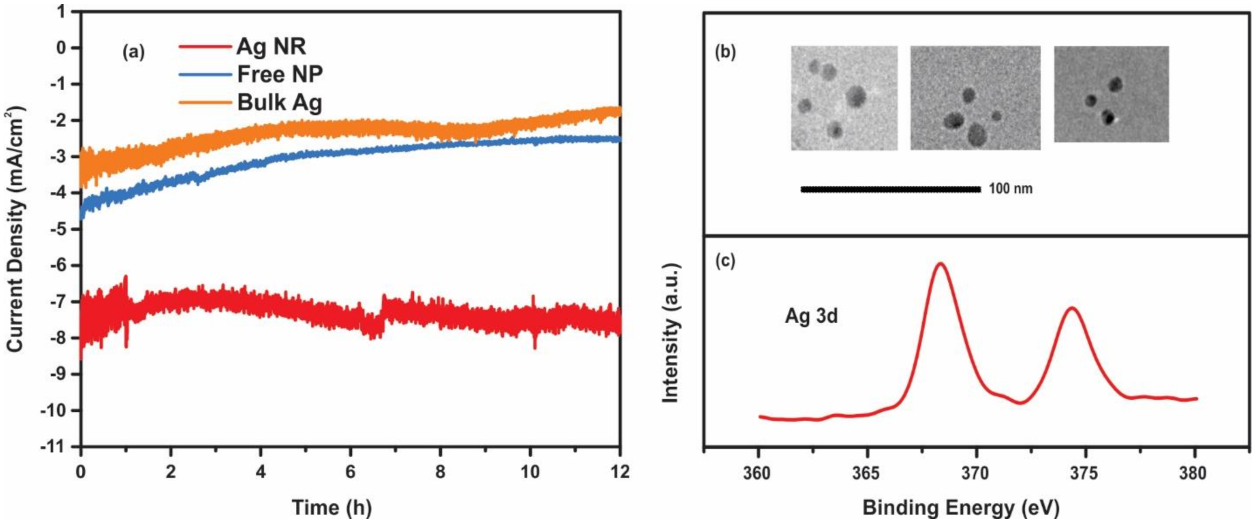

Figure S8. Twelve hours durability test at a potential of -1.028 V from Ag NR, Free NP and Bulk Ag (a); post electrolysis characterization of Ag NR by TEM (b) and XPS spectrum (c).

Table S1. Comparison of some Ag catalysts for CO_2 reduction to CO.

Material	Electrolyte	pH	Highest CO FE	Overpotential[a]	j_{CO}[b] (mA/cm^2)	Ref.
Ag NR	0.5 M $KHCO_3/CO_2$	7.2	95 %	0.918 V	7.8	This work
8 nm Ag	0.5 M $KHCO_3/CO_2$	7.2	82%	0.998 V	3.8	This work
Bulk Ag	0.5 M $KHCO_3/CO_2$	7.2	82%	0.998 V	2.1	This work
3 nm Ag/C	0.5 M $KHCO_3/CO_2$	7.0	76.8%	0.790 V	6.0	R1
5 nm Ag/C	0.5 M $KHCO_3/CO_2$	7.0	79.2%	0.640 V	6.0	R1
10 nm Ag/C	0.5 M $KHCO_3/CO_2$	7.0	72.6%	0.790 V	3.0	R1
Triangular Ag nanoplate	0.1 M $KHCO_3/CO_2$	7.0	96.8%	0.746 V	1.2	R2
Spherical Ag NP	0.1 M $KHCO_3/CO_2$	7.0	65.4%	0.846 V	1.7	R2
Ag plate	0.5 M $KHCO_3/CO_2$	7.2	~ 60%	0.79 V~ 0.99 V	-	R3
35 nm Ag nanowire	0.5 M $KHCO_3/CO_2$	7.2	78.0%	0.790 V	-	R3

[a]The overpotential that needed at highest CO FE. [b]The CO current density under the overpotential in the left column.

[R1] Kim, C.; Jeon, H. S.; Eom, T.; Jee, M. S.; Kim, H.; Friend, C.M.; Min, B. K.; Hwang, Y. J. Achieving Selective and Efficient Electrocatalytic Activity for CO_2 Reduction using Immobilized Silver Nanoparticles. *J. Am. Chem. Soc.* **2015,** *137*, 13844−13850.

[R2] Liu, S.; Tao, H.; Zeng, L.; Liu, Q.; Xu, Z.; Liu, Q.; Luo, J. L. Shape-Dependent Electrocatalytic Reduction of CO_2 to CO on Triangular Silver Nanoplates. *J. Am. Chem. Soc.* **2017,** *139*, 2160−2163.

[R3] Xi, W.; Ma, R.; Wang, H.; Gao, Z.; Zhang, W.; Zhao, Y. Ultrathin Ag Nanowires Electrode for Electrochemical SyngasProduction from Carbon Dioxide. *ACS Sustainble Chem. Eng.* **2018,** *6*, 7687-7694.