Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Pt-MoO_3-RGO Ternary Hybrid Hollow Nanorod Arrays as High-Performance Catalysts for Methanol Electrooxidation

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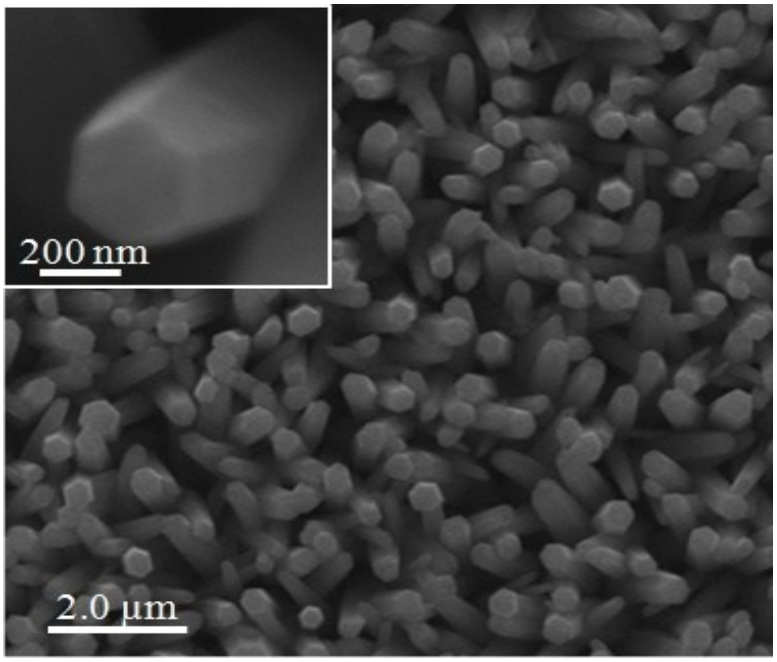

Figure S1. SEM image of ZnO NRAs.

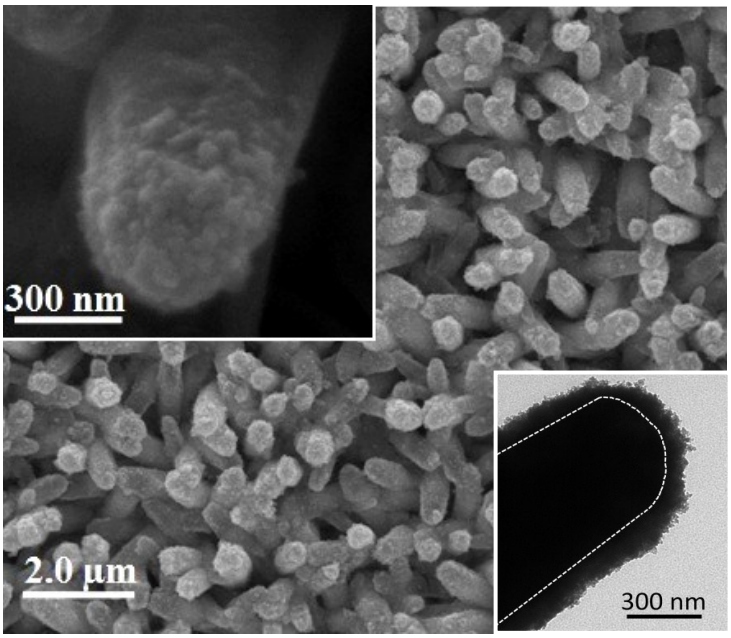

Figure S2. SEM image of ZnO@MoO_3-Pt-RGO composite NRAs. (The core-shell structure of ZnO@MoO_3-Pt-RGO NRAs is characterized by the TEM shown in inset).

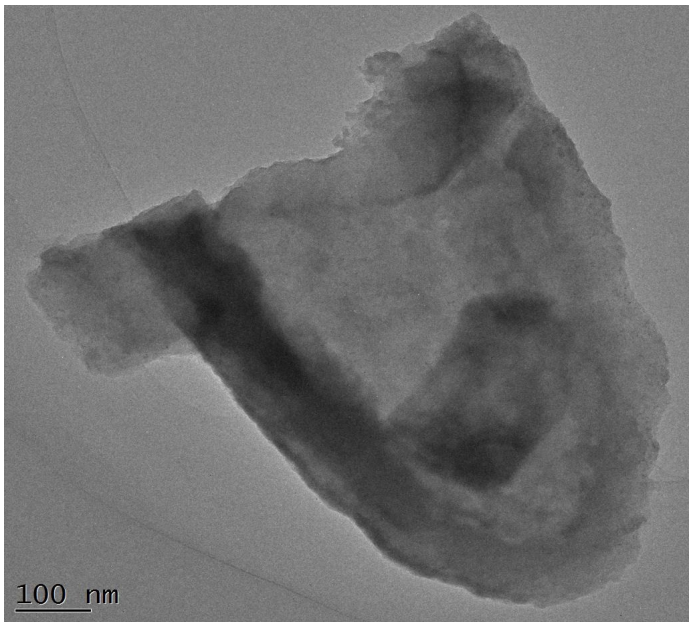

Figure S3. TEM image of a broken MoO_3-Pt-RGO hollow nanorod.

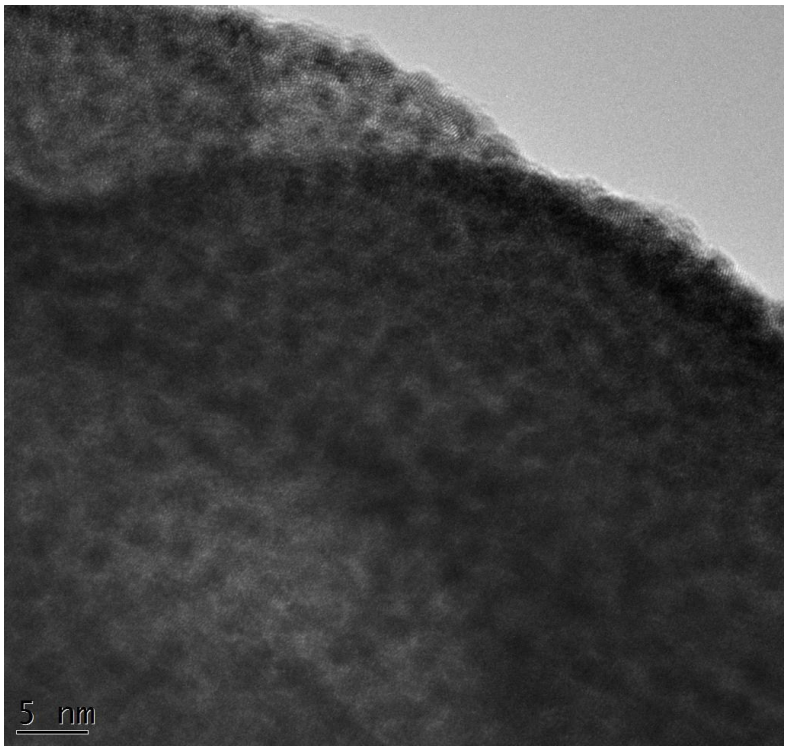

Figure S4. TEM image of high dispersive Pt nanocrystals in the walls of Pt-MoO_3-RGO HNRAs.

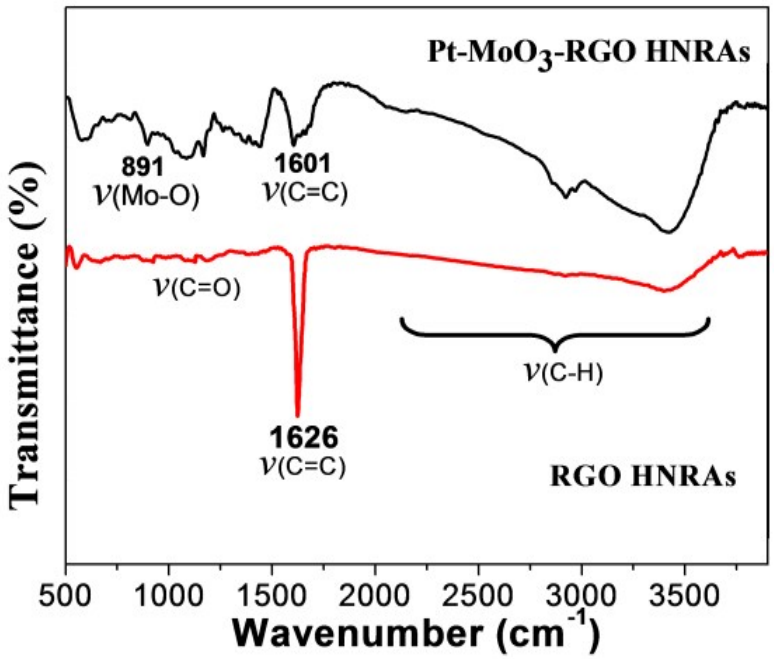

Figure S5. IR spectra measured on Pt-MoO_3-RGO HNRAs (black) and RGO HNRAs (red).

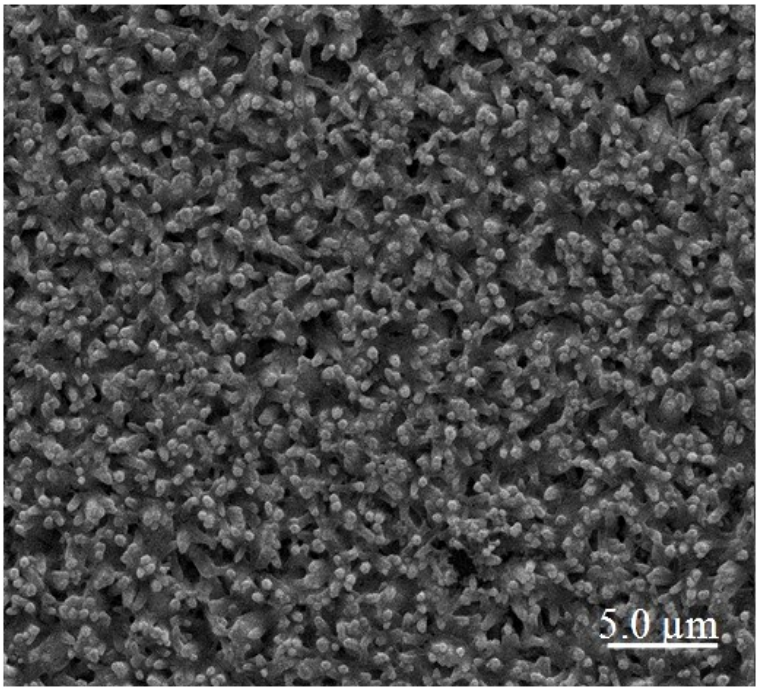

Figure S6. SEM image of Pt-MoO_3 hybrid HNRAs.

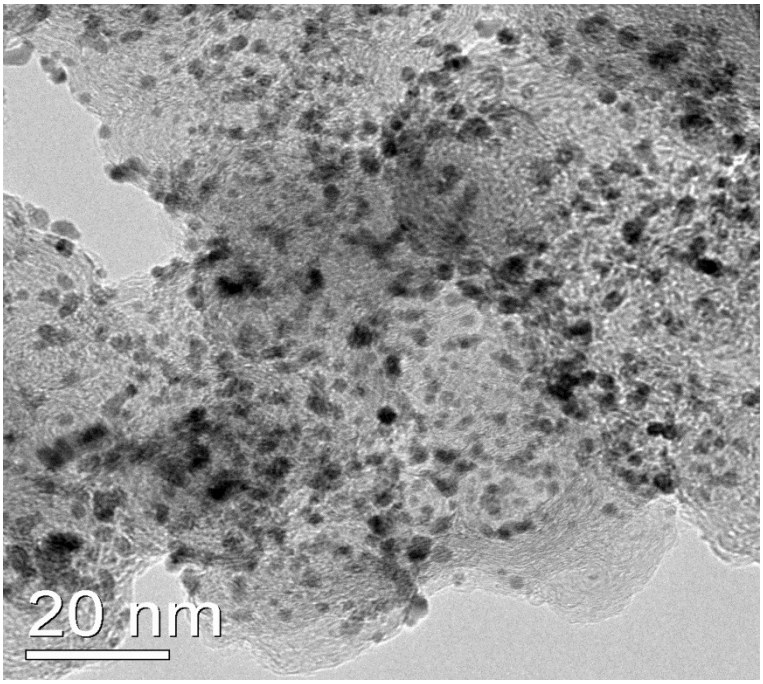

Figure S7. TEM image of commerical Pt/C catalysts.

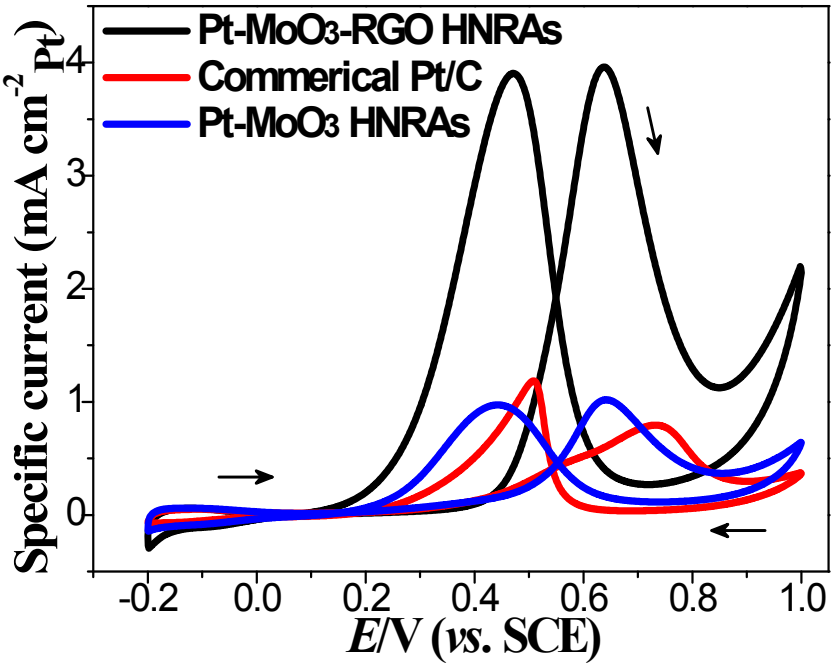

Figure S8. CVs of catalysts measured in 0.5 M CH_3OH+0.5 M H_2SO_4 solution at 50 mV/s with specific current density of ECSA.

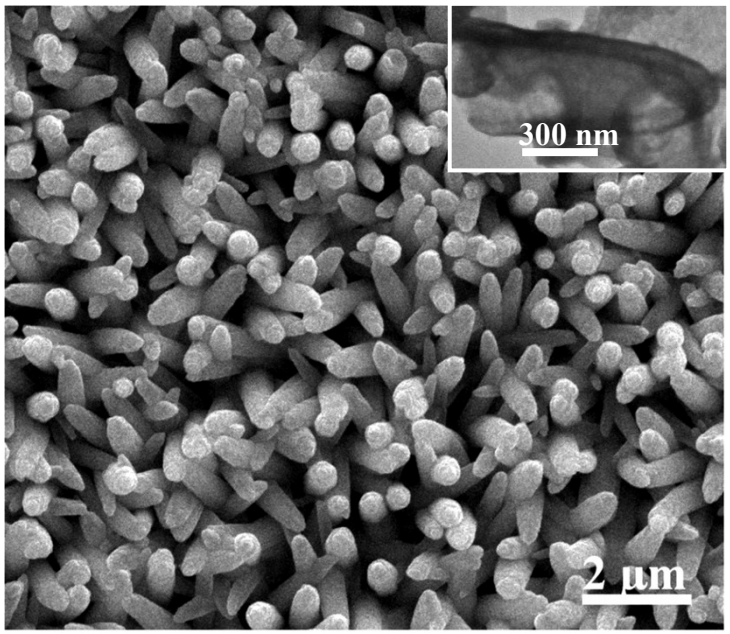

Figure S9. SEM image of Pt-MoO_3-RGO HNRAs after 200 cycles.

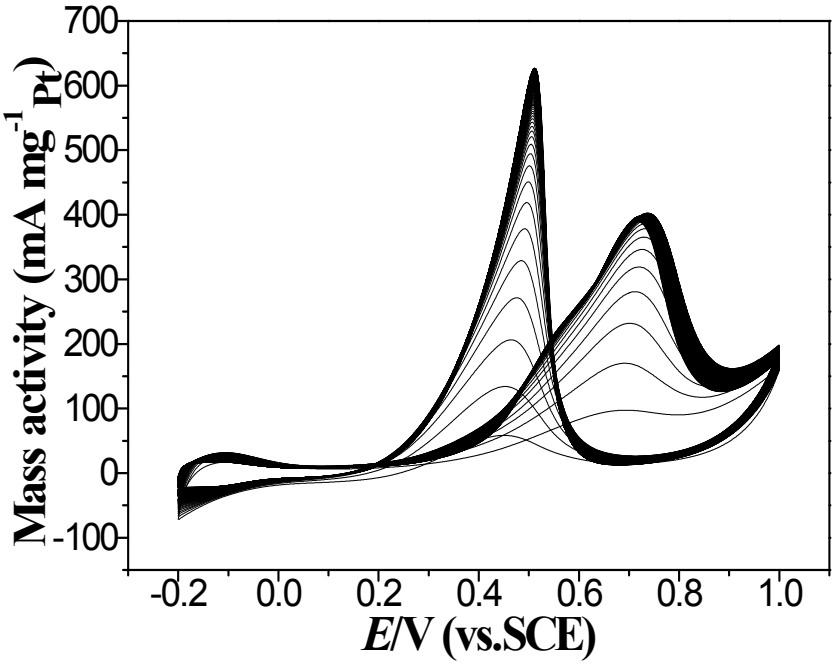

Figure S10. CVs of commerical Pt/C catalysts from 1st to 200th cycle.

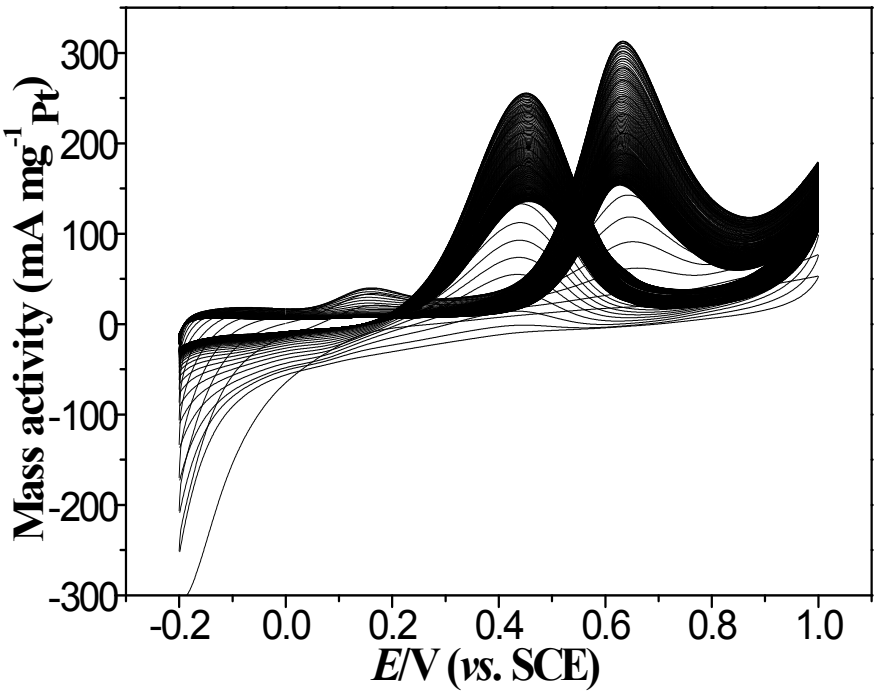

Figure S11. CVs of Pt-MoO_3 HNRAs catalysts from 1st to 200th cycle.

Table S 1. Mass activity comparisons of Ni@Pt@Ni@Pt NTAs with other Pt-based electrocatalysts.

Elecrocatalyst	Mass current density (mA /g)	Testing solution	Reference
Pt-MoO_3-RGO NTAs	809.5	0.5 M H_2SO_4 + 0.5 M CH_3OH	This work
$Pt_{0.75}(RuO_2\text{-}MoO_3)_{0.25}$/C	31	0.5 M H_2SO_4 + 0.5 M CH_3OH	1
Pt–MoOx(10%)-MWCNT	46.58	0.5 M H_2SO_4 + 0.5 M CH_3OH	2
Pt-MoOx/CNTs	250	0.5 M H_2SO_4 + 1.0 M CH_3OH	3
PtRu(7:3)/MWCNTs	115	0.5 M H_2SO_4 + 1.0 M CH_3OH	4
Hollow mesoporous Pt–Ni nanospheres	380	0.5 M H_2SO_4 + 0.5 M CH_3OH	5
PVP-Modified Graphite Carbon Nanofibers/PtRu	234	1.0 M H_2SO_4 + 0.5 M CH_4OH	6
PtPd/RGO	198	0.1 M $HClO_4$ + 1.0 M CH_3OH	7
PtRu/graphene	339.2	0.5 M H_2SO_4 + 1.0 M CH_3OH	8
Pt hollow nanocrystal /graphene	218	0.5 M H_2SO_4 + 0.5 M CH_3OH	9
PtRu/MC	19.8	0.5 M H_2SO_4 + 1.0 M CH_3OH	10
PtRu/graphene	205.7	0.5 M H_2SO_4 + 1.0 M CH_3OH	11
Pt/MC/graphene	81.6	0.5 M H_2SO_4 + 0.5 M CH_3OH	12
Pt/N-doped C	103	0.5 M H_2SO_4 + 1.0 M CH_3OH	13
Pt/Sn-modified CNT	91.0	0.5 M H_2SO_4 + 1.0 M CH_3OH	14
Pt/TiO_2/C	102.8	0.5 M H_2SO_4 + 0.5 M CH_3OH	15
PtRu/HPAs-CS/graphene	232	0.5 M H_2SO_4 + 1.0 M CH_3OH	16
Pt MTNN	580.97	0.5 M H_2SO_4 + 1.0 M CH_3OH	17
FePtPd Nanowires	488.7	0.1 M $HClO_4$ + 0.2 M CH_3OH	18
Pt-on-Pd Bimetallic Nanodendrites	490	0.5 M H_2SO_4 + 1.0 M CH_3OH	19
Ni@Pt@Ni@Pt NTAs	362.7	0.5 M H_2SO_4 + 0.5 M CH_3OH	20

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