Supporting Information For

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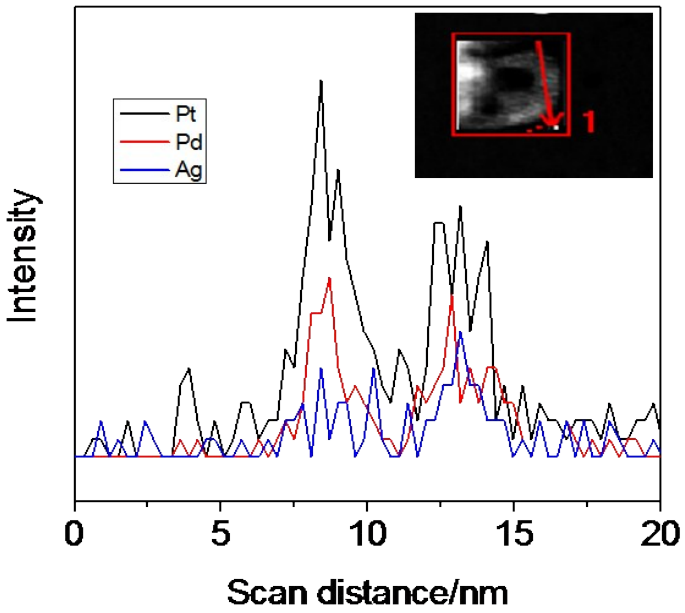


Figure S1. Shows the line scanning profile of PtPdAg hollow nanoparticles.

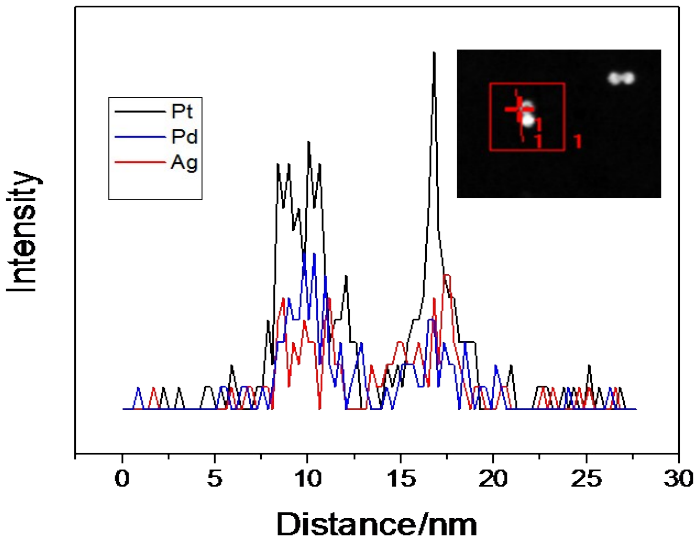


Figure S2. Shows the line scanning profile of PtPdAg nanodimers

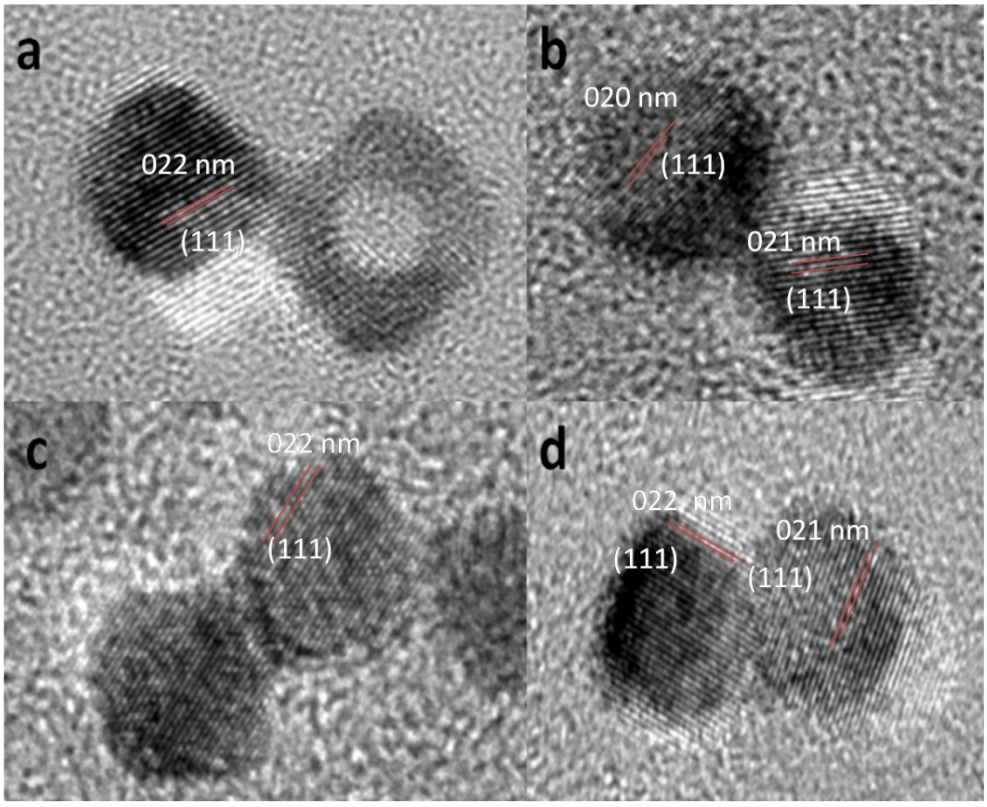


Figure S3**.** HRTEM images of nanodimer.

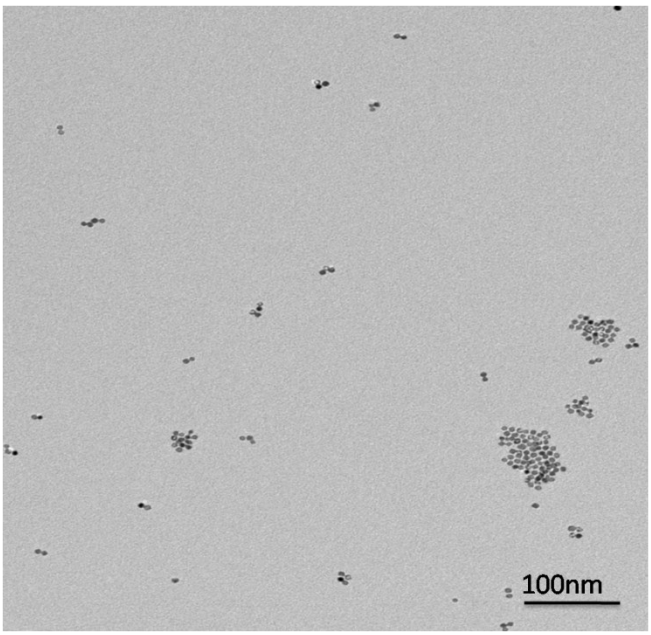


Figure S4**.** TEM images of nanodimer at 100 nm.

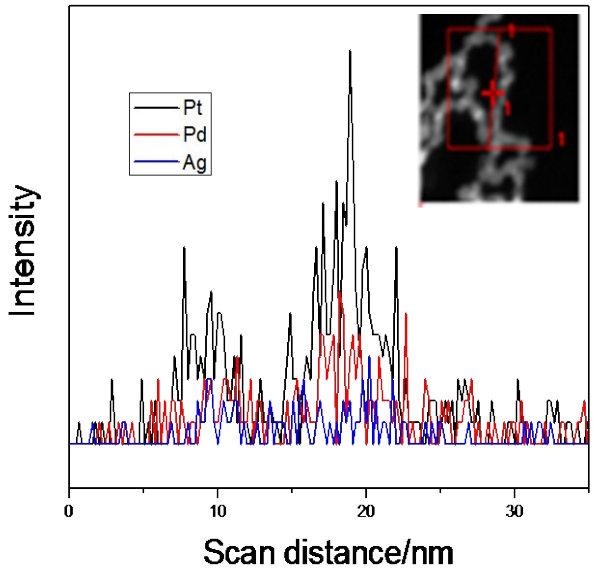


Figure S5. (a) shows the line scanning profile of PtPdAg nanowire.

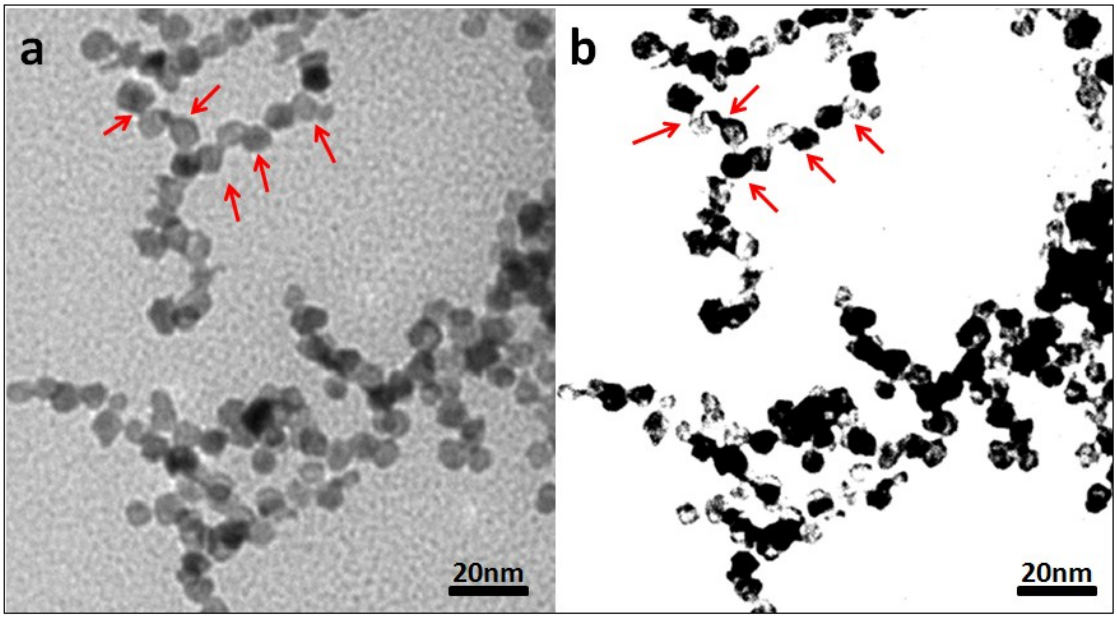


Figure S6. (a) TEM image of wavy nanowires, arrows indicate the nanodimers as monomers while (b) indicate the same TEM image but with bright background.

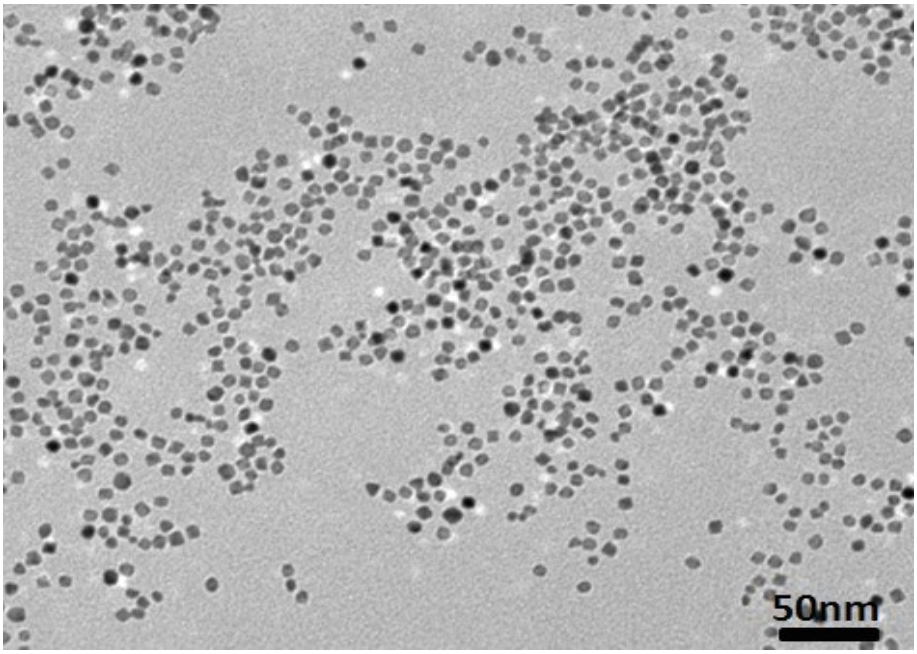


Figure S7. TEM image of nanoparticles obtained at the same condition where we got wavy nanowires but in this cause precursor nanoparticles were highly washed with water.

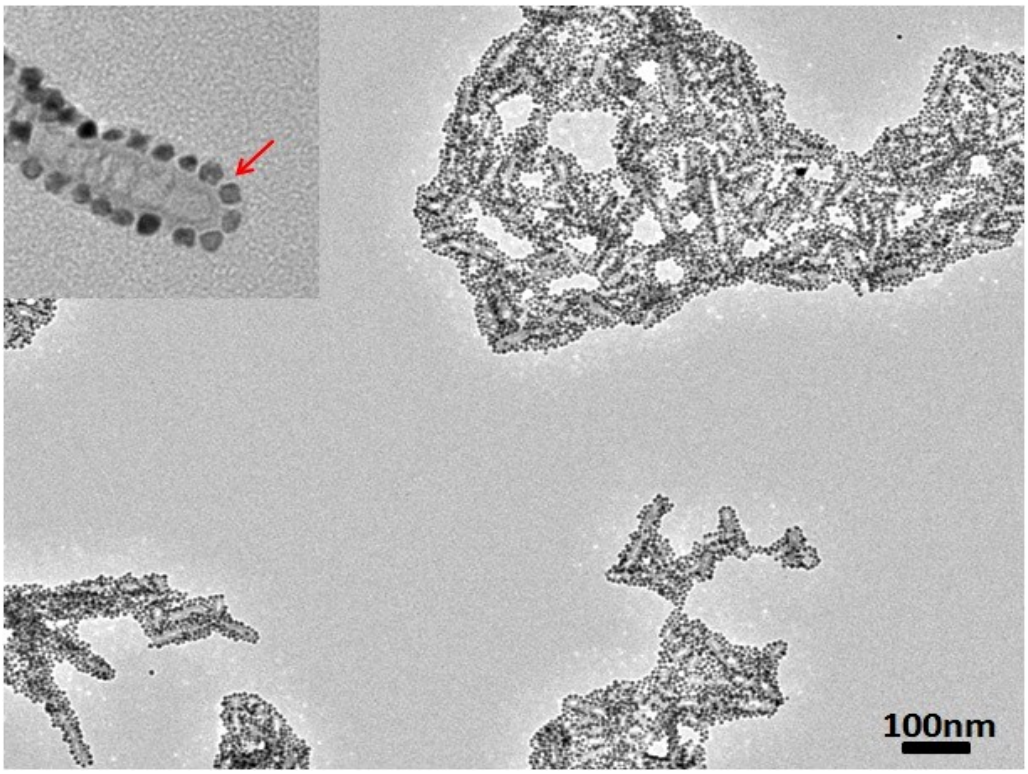


Figure S8. TEM image of nanoparticles obtained at the same condition where we got wavy nanowires but in this cause precursor nanoparticles were not washed well.

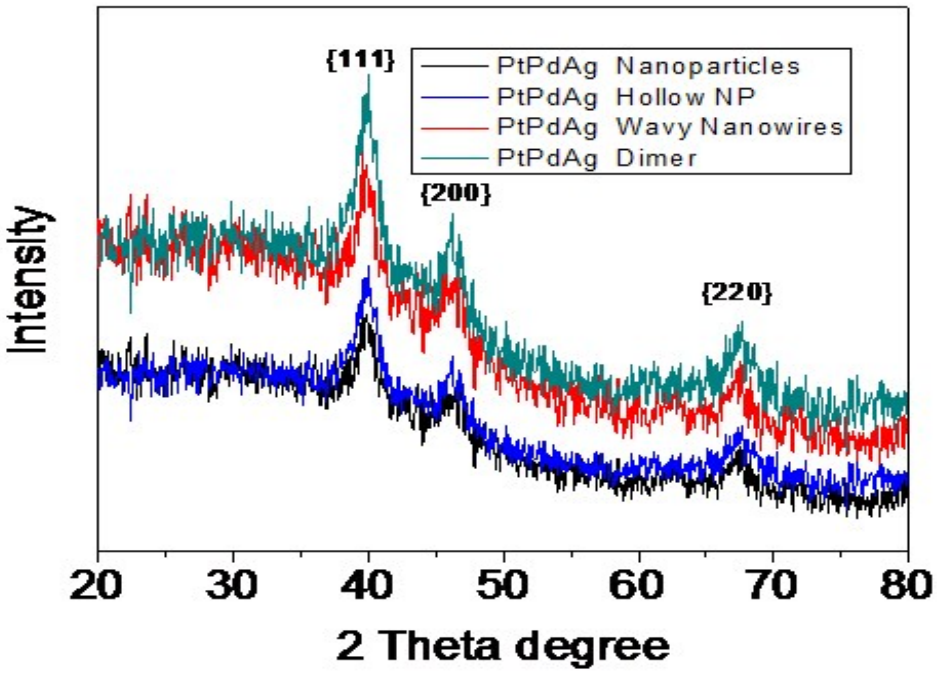
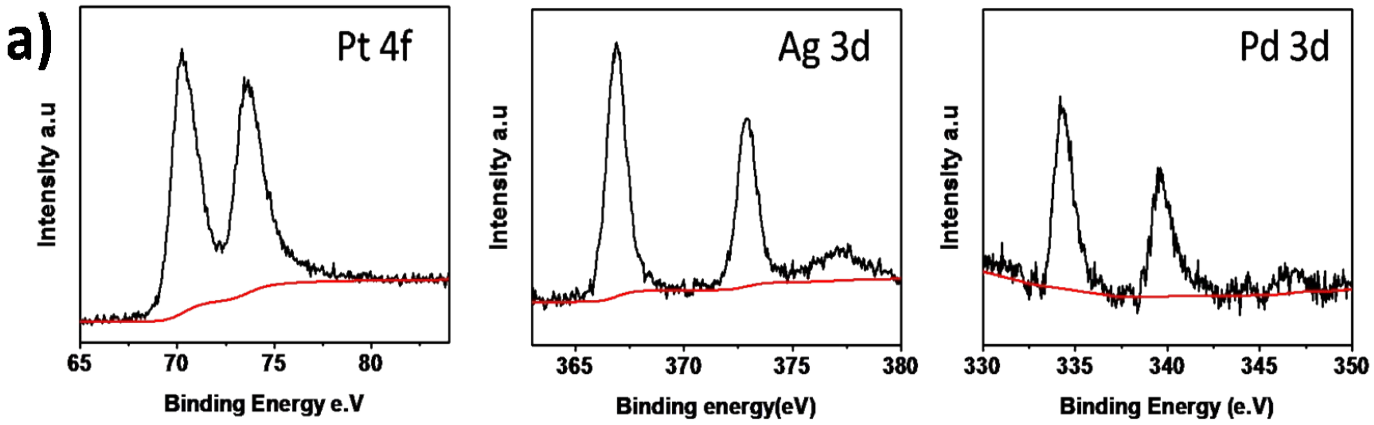


Figure S9. Xrd Paterns of PtPdAg Nanoframes



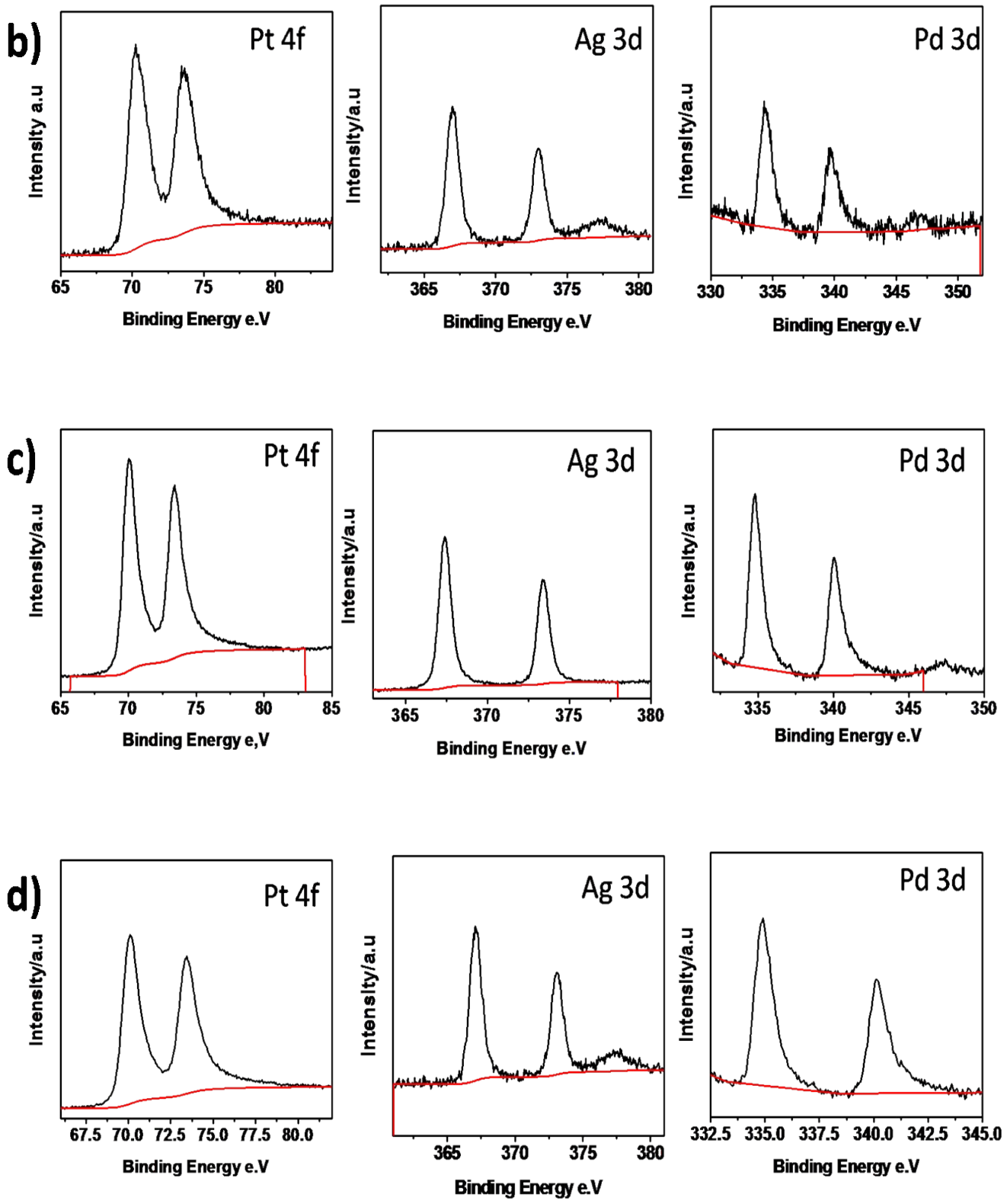


Figure S10. (a) XPS spectrum of PtPdAg Nanoparticles. **(b)**XPS spectrum of PtPdAg hollow nanoparticles**(c)** XPS spectrum of PtPdAg dimer**(d)** XPS spectrum of PtPdAg wave wire.

The Pt4f, Pd 3d, Ag 3d spectra show that on the surface of PtPdAg hollow nanoparticles, Pt, Pd and Ag mainly exist in metallic form. XPS spectrum of Pt 4f displays two peaks at 70.25 eV and 73.42 eV with a spin-orbit separation of 3.17 eV , XPS spectrum of Pd 3d (shows two peaks with spin orbit separation of 5.17) at 334.53 and 339.7 respectively, while XPS spectrum of Ag 3d (shows two peaks with spin orbit separation of 5.9) at 367.2 and 373.1, respectively. XPS spectrum of PtPdAg hollow dimer, exhibits Pt 4f have two peaks at 70.1 eV and 73.4 eV with a spin-orbit separation of 3.3 eV , XPS spectrum of Pd 3d (shows two peaks with spin orbit separation of 5.0) at 335 and 340 respectively, while XPS spectrum of Ag 3d (shows two peaks with spin orbit separation of 5.5) at 367.5 and 373, respectively. XPS spectrum of PtPdAg wave wire, exhibits Pt 4f have two peaks at 70.15 eV and 73.46 eV with a spin-orbit separation of 3.31 eV , XPS spectrum of Pd 3d (shows two peaks with spin orbit separation of 5.4) at 334.8 and 340.2 respectively, while XPS spectrum of Ag 3d (shows two peaks with spin orbit separation of 6.1) at 367.1 and 373.2, respectively.

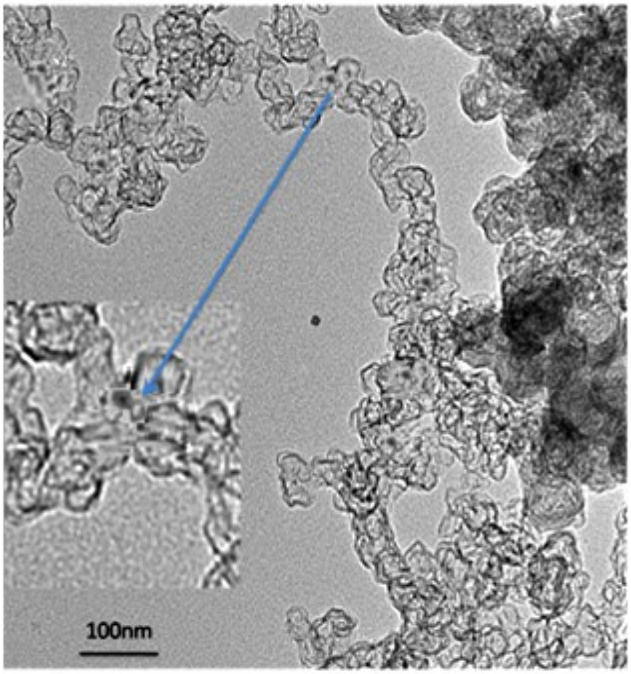


Figure S11. TEM image of images of PtPdAg nanodimer after 10000 cycle stablity test , insect is enlarge image that shows that dimer structutre exist after stability test.

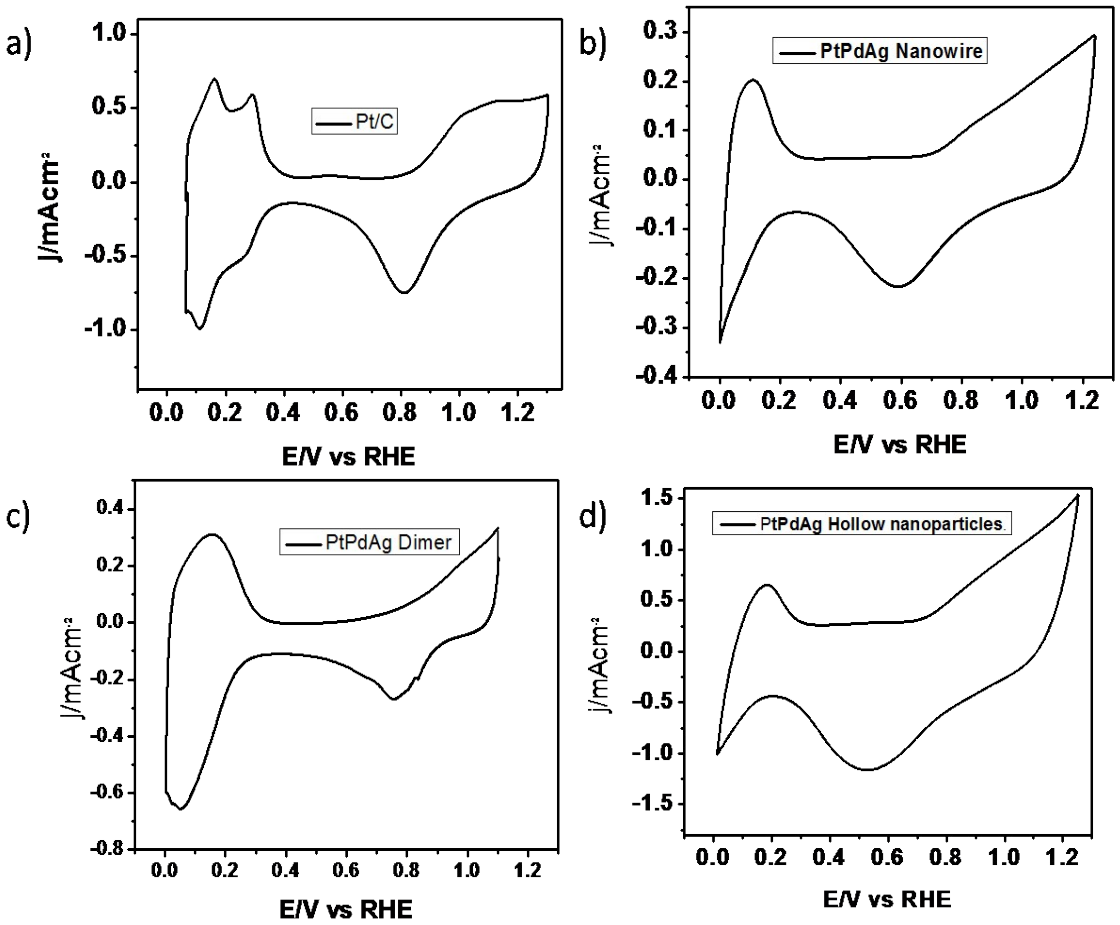


Figure S12. CV curve of catalyst in N_2-saturated 0.1M $HClO_4$ solutions(a) Pt/C (b) PtPdAg/C Hollow nanoparticles. (c) PtPdAg/C nanodimers (c) PtPdAg/C nanowires.

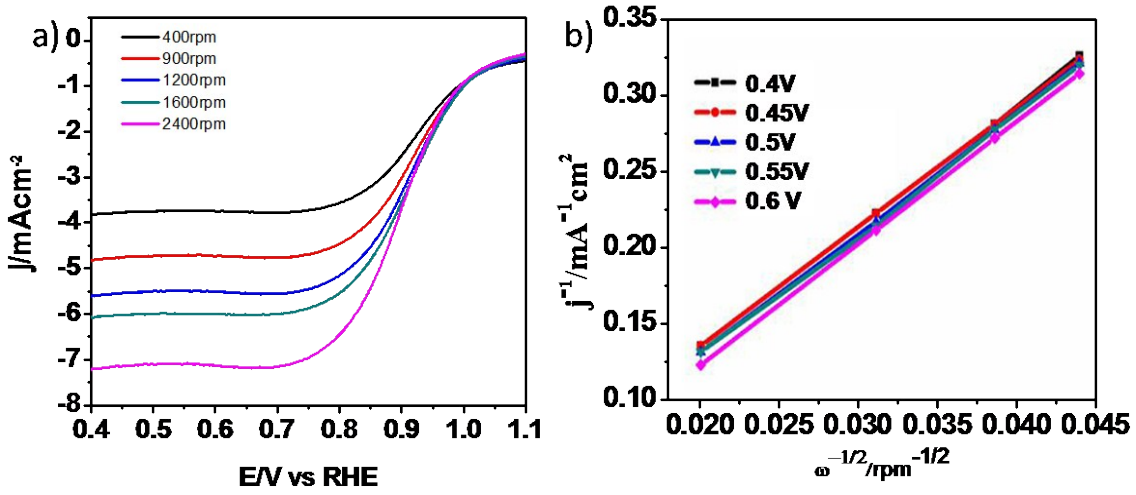


Figure S13. (a) RDE voltammograms at different rotating speeds for PtPdAg dimers, b) Koutecky-Levich plots of PtPdAg dimers in O_2 saturated 0.1 M $HClO_4$ solution from 0.6 to 1.0 V vs. RHE.

Table S1. The composition of PtPdAg Nanoframes determined by ICP-OES

Sample	Mole ratio determined by ICP-OES
PtPdAg Nanoparticles	45:35:20
PtPdAg Hollow Nanoparticles.	61:30.7:8.3
PtPdAg Nanodimers.	69:25:6
PtPdAg Nanowires.	63:26.5:10.5

Table S2. Comparison of Specific activity and mass activity between as prepared PtPdAg dimers and ORR electrocatalyst in literature.

Catalyst	SA at 0.9 V_{RHE}($mAcm_{Pt}^{-2}$)	MA at 0.9 VRHE (Amg_{Pt}^{-1})	Reference
Pt/C	0.24	0.16	This paper, 27
$PtPdAg_D$	1.73	0.66	This Paper
PtCu NF	1.71	0.211	28
PtPdNC	1.28	------	29
Pd@Pt	0.91	0.41	21
PtCuTi	0.84	0.256	30
Pt@Ag/Pt	-----	0.438	31
Pd@Pt Tp	0.5	0.381	32
PtAg NC	1.23	0.64	33
PtPd NPG	0.58	1.14	34
PtPd NC	1.98	0.75	i
PtNC	3.5	1.28	ii

DFT calculations:

We have carried out the spin polarized first-principles calculations by utilizing Vienna ab initio simulation package(VASP) [37-38]. To deal with iron cores we have adopted the projector-augmented wave potentials [39]. A plane-wave basis-set with a cut off energy of 500eV is used treat the valance electrons with the Perdew-Burke-Ernzerhof (PBE) exchange-correlation functional [40]. **.** A 5×5×1 k-point mesh was chosen [41], for the Brillouin-zone sampling. Moreover, all the structures were relaxed until the Hellmann-Feynman forces found to be less than 0.02 eV/$Å^{-1}$.A 2×2 supercell was used in these calculations. Furthermore, we have calculated the E_O value by placing an O atom on the available sites using the oxygen binding energy equation:

$$E_O = E_{[Alloy+O]} - E_{[Alloy]} - E_{[O2]}/2.$$

Where, $E_{[Alloy+O]}$ and $E_{[alloy]}$denotes the calculated total energies of with and without the O adsorbate and $E_{[O2]}$ is denoted the total energy of an isolated oxygen molecule, respectively.

Table S3 The calculated absorption energies of O atom on PtPdAg alloy

Samples	with different compositions	E_{ads} (eV)	ΔE_{ads} (eV)
Pt(111)		-4.34	
PtPdAg dimer	69:25:6	-3.85	0.49
PtPdAg nano particles	45:35:20	-4.21	0.130
PtPdAg hollow particles	61:30.7:8.3	-3.90	0.435

Reference.

i. L. Zhang, L. T. Roling, X. Wang, M. Vara, M. Chi, J. Liu, S.-I. Choi, J. Park, J. A. Herron, Z. Xie, M. Mavrikakis and Y. Xia, Science, 2015, 349, 412–416.

ii. X. Wang, L. Figueroa-Cosme, X. Yang, M. Luo, J. Liu, Z. Xie and Y. Xia, Nano Lett., 2016, 16, 1467–1471.