*Supporting information for Catalysis Science and Technology*

**One pot two step rapid synthesis of 3-aminopropyl trimethoxy silane mediated highly catalytic Ag@(PdAu) trimetallic nanoparticle**

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**1. UV-VIS spectral recording for (PdAu)sim and (Au@Pd)seq**

Sequential (Au@Pd) bimetallic nanoparticles are made by adding $Au^{3+}$ to presynthesized PdNPs (procedure and spectral recording shown in Fig.1 of main text). SPR peak corresponding to AuNPs becomes visible with the addition of $Au^{3+}$ immediately (Fig. S1- A). 3-APTMS capped $Pd^{2+}$ and $Au^{3+}$ are simultaneously reduced in the presence of formaldehyde. Fig. S1- B (ii) shows the uv-vis spectra of bimetallic nanoparticles.

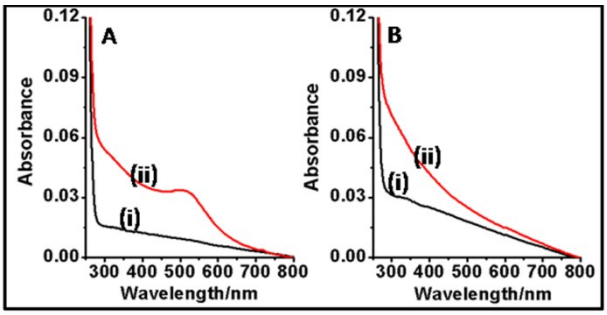


**Figure S 1 UV-VIS spectra displaying synthesis of PdAu bimetallic nanoparticles made (A) sequentially and (B) simultaneously.**

**Table S 1 d-spacing values for rings obtained in diffraction pattern of synthesized nanoparticles**

| | d1<br>(111) | d2<br>(200) | d3<br>(220) | d4<br>(311) |
|---|---|---|---|---|
| Pdcore | 2.2805 | 1.9735 | 1.3592 (Pd) | 1.15306 (Pd) |
| (PdAu) | 2.2805 | 2.05245 (Au) | | 1.1795 (Pd) |
| Ag@(PdAu) | 2.2805 | 2.0322<br>(Au and Ag) | 1.3592(Pd) | 1.1661 (Pd) |
| Au@Pd | 2.2805 | 2.05245 (Au) | 1.3592(Pd) | 1.15306 (Pd) |

**2. Enlarged TEM images of Pd, Au@Pd and PdAu nanoparticles.**

The figure shows the enlarged TEM images of PdNPs (A), Au@PdNPs and PdAuNPs. Aggregates of PdNPs (A) are formed that remain unaffected due to sequential AuNPs (B) addition. Both show gradual degradation. Simulataneously made PdAuNPs (C) show segregated structures with Au forming core and palladium forming the shell (highlighted by red circles).

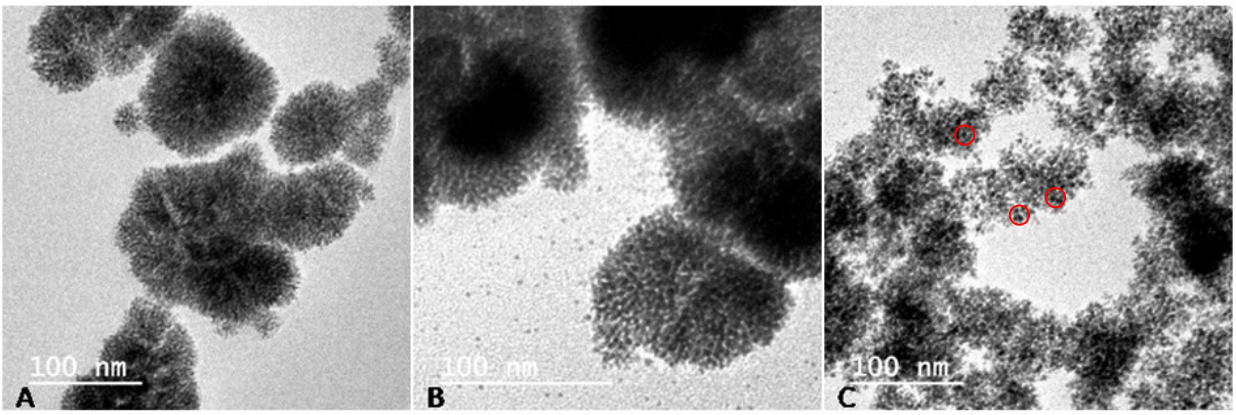


**Figure S2 Enlarged images to show the gradual degradation in (A) and (B) and contrast difference between Au core- Pd Shell in (C)**

**3. UV-VIS spectral recording depicting effect of $Au^{3+}$ concentration on (PdAu)sim and addition of $Ag^{+}$ to the simulataneously made (PdAu) using different $Au^{3+}$ concentration.**

SPR peak corresponding to AuNPs in simultaneously made bimetallic (PdAu) nanoparticles becomes evident with increasing concentration of $Au^{3+}$ (5mM- 20mM) as shown in Fig. S2 A. Fig. S2 B gives the effect of addition of similar concentration of $Ag^{+}$ to simultaneously made (PdAu) bimetallic nanoparticles made using different concentration of $Au^{3+}$ (Fig. S2 A). SPR peak corresponding to AgNPs becomes visible only when $Au^{3+}$ concentration is low. At higher $Au^{3+}$ concentration peak is not visible. Alloying between Au and Ag , with very close lattice constant values, could be the explaination for the result obtained.

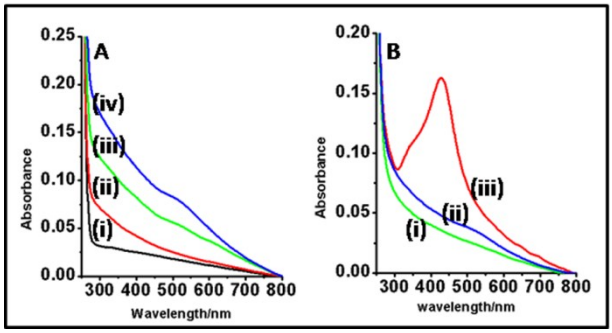


**Figure S 3 UV-VIS spectra displaying (A) effect of increasing $Au^{3+}$ concentration on simultaneously made (PdAu) bimetallic nanoparticles i- 0mM, ii- 5mM, iii- 10mM, iv- 20mM; (B) 20mM $Ag^{+}$ added to the simultaneously made (PdAu)NPs with $Au^{3+}$ concentration i-5mM, ii-10mM, iii-20mM.**

## 4. XPS spectra of monometallic PdNPs, bimetallic (PdAu)NPs, trimetallic Ag@(PdAu)NPs.

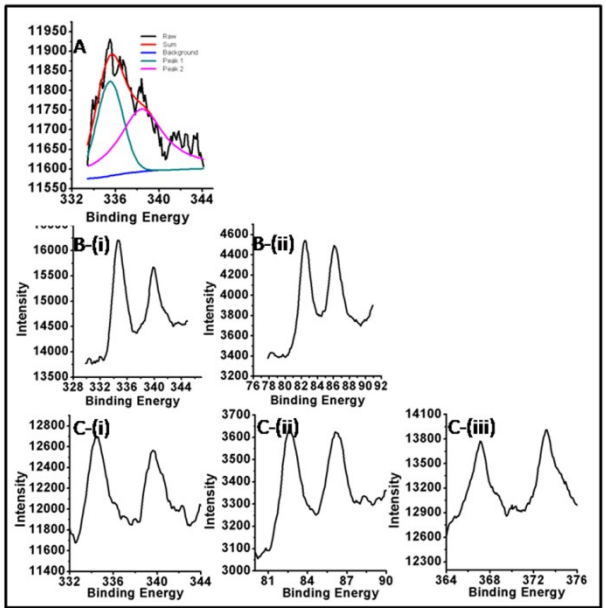


**Figure S 4 XPS spectra of (A) PdNPs; (B) i- Pd and ii- Au in (PdAu) bimetallic nanoparticles (C) i- Pd, ii- Au and iii-Ag in Ag@(PdAu) trimetallic nanoparticles.**

**Table S2 Binding Energy data for individual components of PdNPs, (PdAu)NPs and Ag@(PdAu).**

| Nanoparticles | Pd (Binding Energy) | Au (Binding Energy) | Ag(Binding Energy) |
|---|---|---|---|
| PdNPs | 335.5ev | - | - |
| (PdAu)NPs | 334.6ev | 82.5ev | - |
| Ag@(PdAu)NPs | 334.39ev | 82.6ev | 367.1ev |

## 5. Effect of acid on the SPR peak of AuNPs and AgNPs.

HCl is added to the homogenous nanoparticle suspension for its conversion to heterogenous system. It is mandatory to ensure that nanogeometry does not get affected with the addition of acid as catalyzing power depends directly on it. As any change in $\lambda_{max}$ corresponds directly to the change in size. Nanoparticles stability in the presence of HCl is checked and found to remain unaffected as shown in Fig. S4.

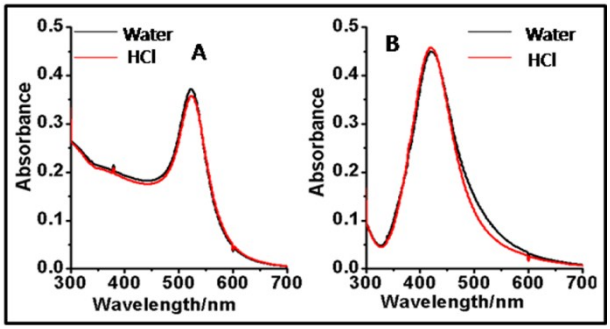


**Figure S 5 UV-VIS spectra displaying effect of 0.1M HCl on SPR peak of (A) AuNPs and (B) AgNPs.**