

Supplementary Information

X-ray Diffraction

In order to confirm the presence of nickel, Cu₇₅Ni₂₅ was annealed at 400 °C for 5hrs and the phase confirmation was done by XRD (Fig. S1). The XRD pattern clearly depicts the characteristic peaks of both monoclinic copper oxide (ICDD: 98-000-6038) and cubic nickel oxide (ICDD: 98-000-9032). This confirms the presence of nickel alloyed with copper in Cu₇₅Ni₂₅ which on annealing oxidized to nickel oxide.

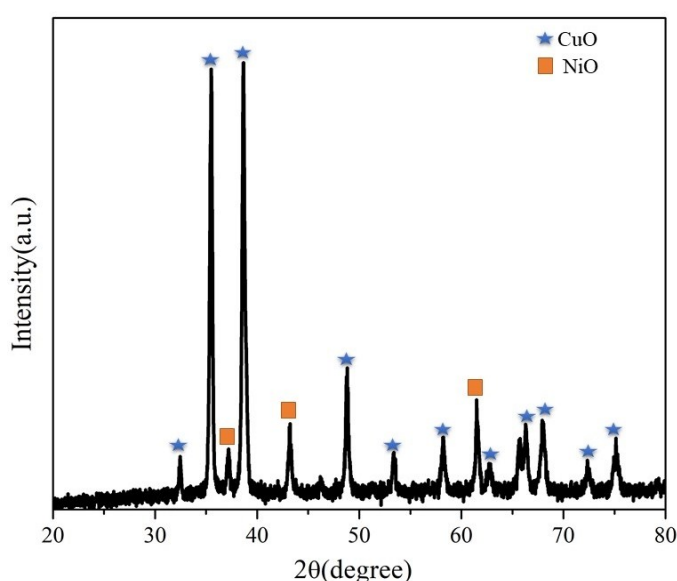


Fig. S1 XRD pattern for Cu₇₅Ni₂₅ sample annealed at 400 °C for 5hrs

UV-visible Spectroscopy

To understand the synergistic effect in Cu₇₅Ni₂₅ which arise from the atomic level mixing, we physically mixed Cu and Ni in the appropriate molar ratio to get the equivalent of Cu₇₅Ni₂₅ (Cu₇₅-Ni₂₅) and tested the catalytic activity as per the procedure discussed in section 2.3. of the manuscript. We also tested with Cu having molar fraction equivalent to that in Cu₇₅Ni₂₅ but without Ni (sample designated as Cu₇₅). Fig. S2 shows the UV-visible spectroscopy regarding the catalytic activity of Cu₇₅-Ni₂₅ (physically mixed), Cu₇₅(75 wt. %) and the rate constant of the samples in comparison with Cu₇₅Ni₂₅ and the calculated rate constant was

found to be $\sim 0.8 \times 10^{-3} \text{ s}^{-1}$ for both the samples. In spite of the similar composition, physically mixed Cu75-Ni25 very poor catalytic activity in comparison to the bimetallic alloy (rate constant $22.52 \times 10^{-3} \text{ s}^{-1}$). Formation of solid solution in Cu75Ni25 increases the scattering of electrons and increases the catalytic activity as discussed in the manuscript indicating the importance of catalyst structure than the composition.

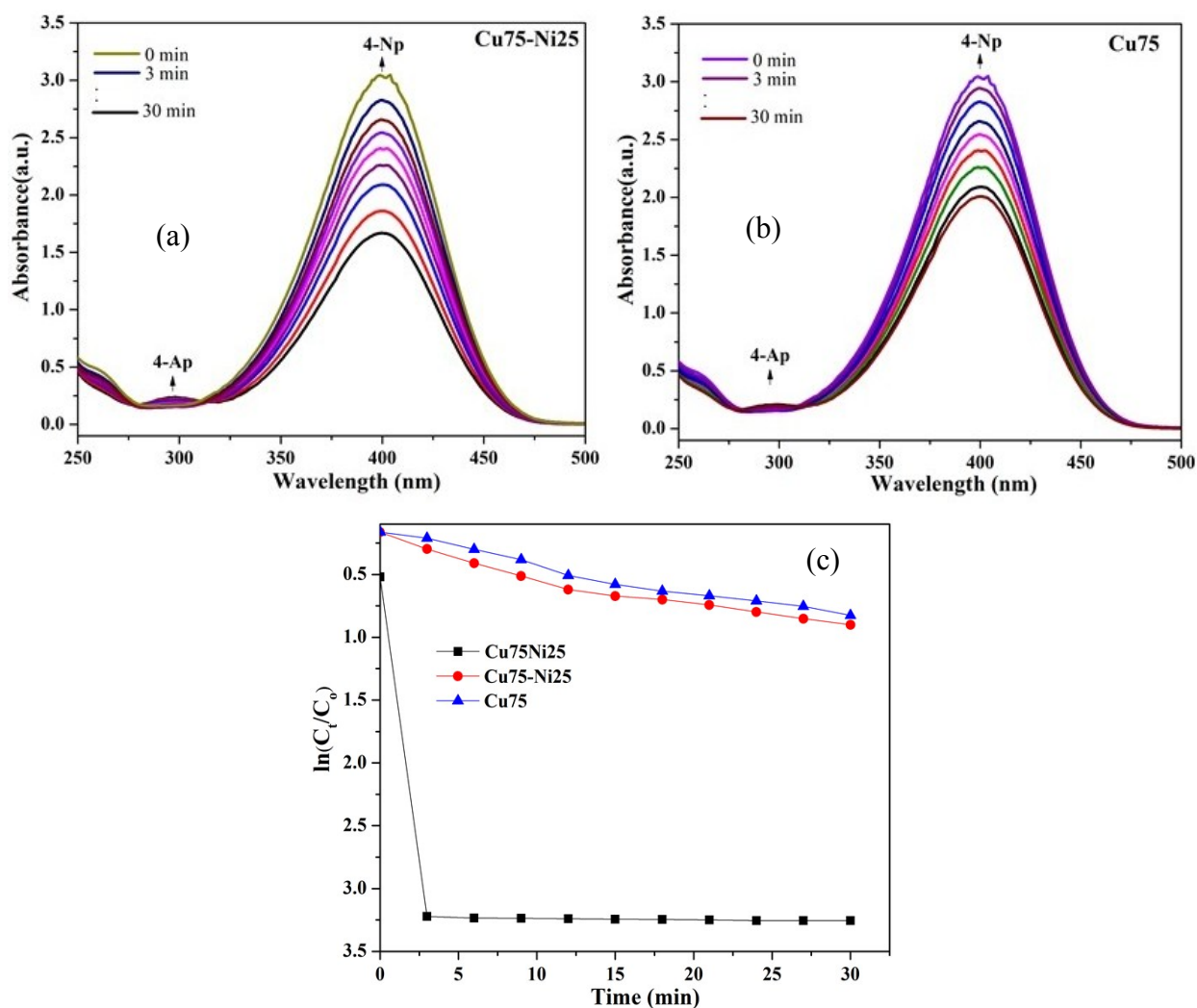


Fig. S2 UV-visible spectroscopy of catalytic activity of (a) Cu75-Ni25 (b) Cu75 and (c) rate constant of Cu75Ni25, Cu75-Ni25 and Cu75.

Table S1 Rate constant value of Cu75Ni25, Cu75-Ni25 and Cu75

Sl .No	Sample Code	Rate Constant (s ⁻¹) x 10 ⁻³
1	Cu75Ni25 (as synthesised)	22.52
2	Cu75-Ni25 (Physically mixed)	0.855
3	Cu75 (Copper 75 wt%)	0.828

Recyclability test

Fig. S3 shows the recyclability test carried out upto six cycles of Cu75Ni25 which is recovered from first cycle using a magnet.

Fig. S3 UV-Visible spectroscopy of Cu75Ni25 for 4-nitrophenol reduction after (a) 2 (b) 3 (c) 4 (d) 5 and (e) 6 cycles