

**Title**  $\text{Cu}_{0.33}@\text{Co}_{0.22}\text{Ni}_{0.45}$  core-shell nanoparticles as hydrogen generation catalysts via hydrolysis of ammonia borane

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**Table S1** The ratios of Cu/Co/Ni for  $\text{Cu}_{0.33}@\text{Co}_{0.22}\text{Ni}_{0.45}$  tested by ICP.

Ratio of Cu/Co/Ni (mol/mol/mol) in preparation	Cu/Co/Ni (ppm) tested by ICP	Cu/Co/Ni (at %) tested by ICP
2:1:1	42.75:26.55:54.39	0.33:0.22:0.45

**Table S2** Material constant and model size.

Element	Elastic modulus (GPa)	Poisson's ratio	Coefficient of linear expansion	Radius (nm)
Core (Cu)	119	0.326	$18 \times 10^{-6}$	36
Shell (Co)	210	0.320	$12 \times 10^{-6}$	43
Shell (Ni)	207	0.291	$13 \times 10^{-6}$	50