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**Title**  $Cu_{0.33}$ @ $Co_{0.22}Ni_{0.45}$  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  $Cu_{0.33}@Co_{0.22}Ni_{0.45}$  tested by ICP.

Ratio of Cu/Co/Ni (mol/mol/mol) in	Cu/Co/Ni (ppm) tested	Cu/Co/Ni (at %)
preparation	by ICP	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	Poisson's ratio	Coefficient of linear	Radius
	(GPa)		expansion	(nm)
Core (Cu)	119	0.326	$18\times10^6$	36
Shell (Co)	210	0.320	$12\times10^6$	43
Shell (Ni)	207	0.291	13×10 <sup>6</sup>	50