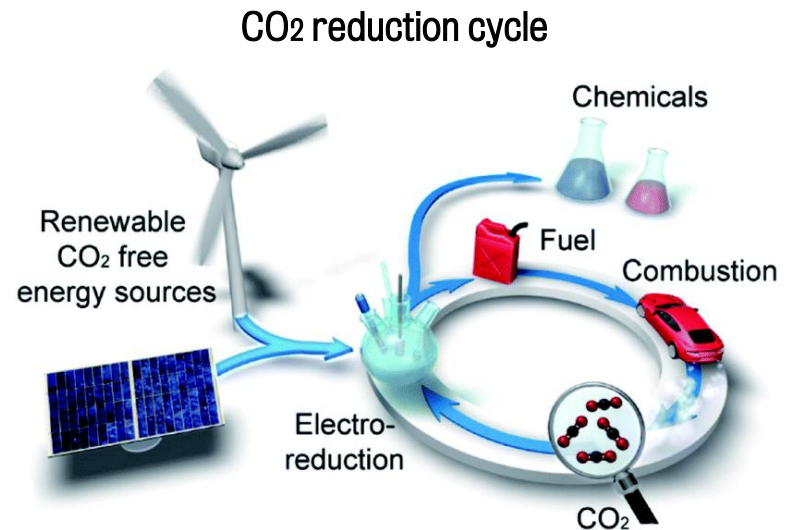
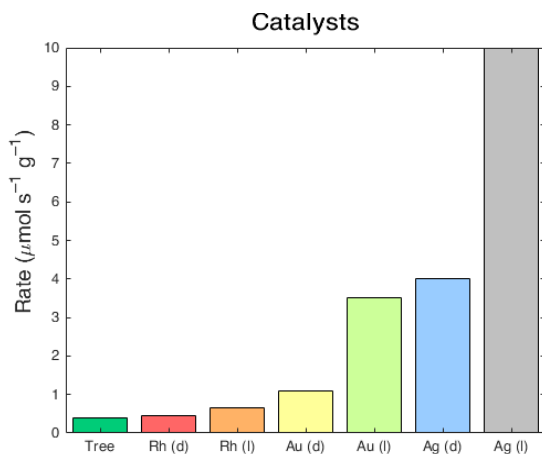


Plasmonics metamaterials for CO₂ reduction

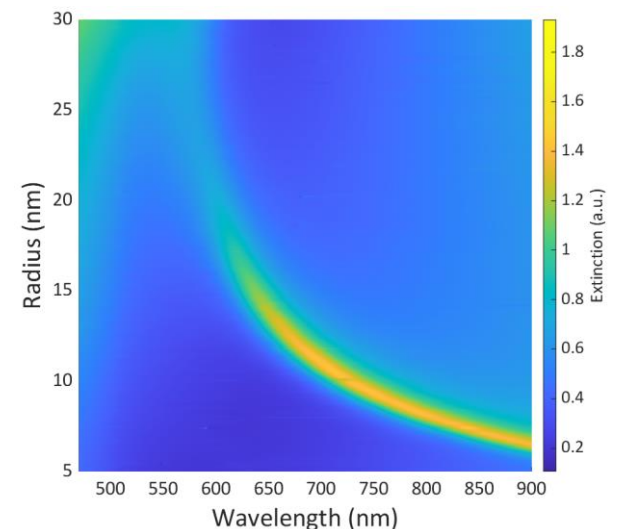
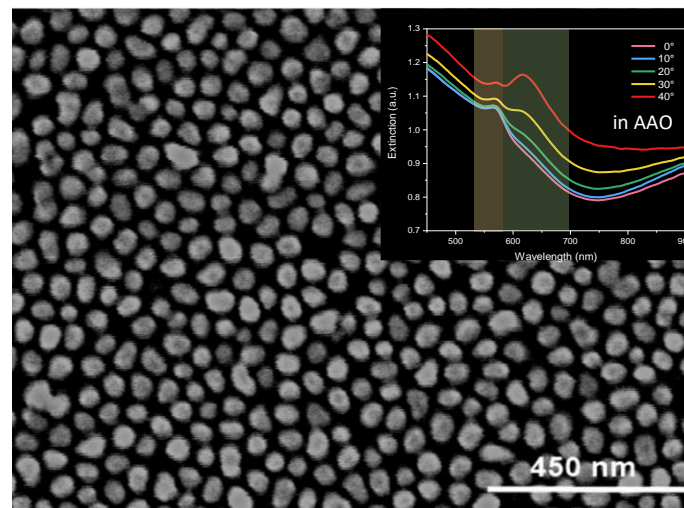
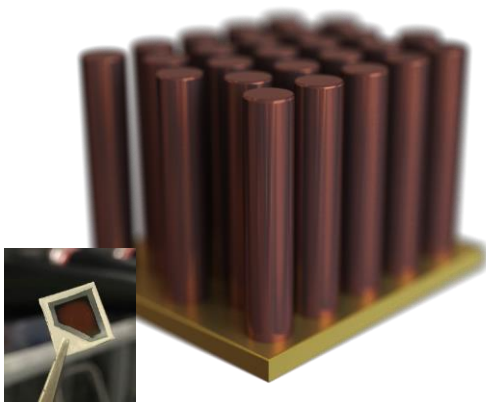
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Ideal catalysts for CO₂ reduction

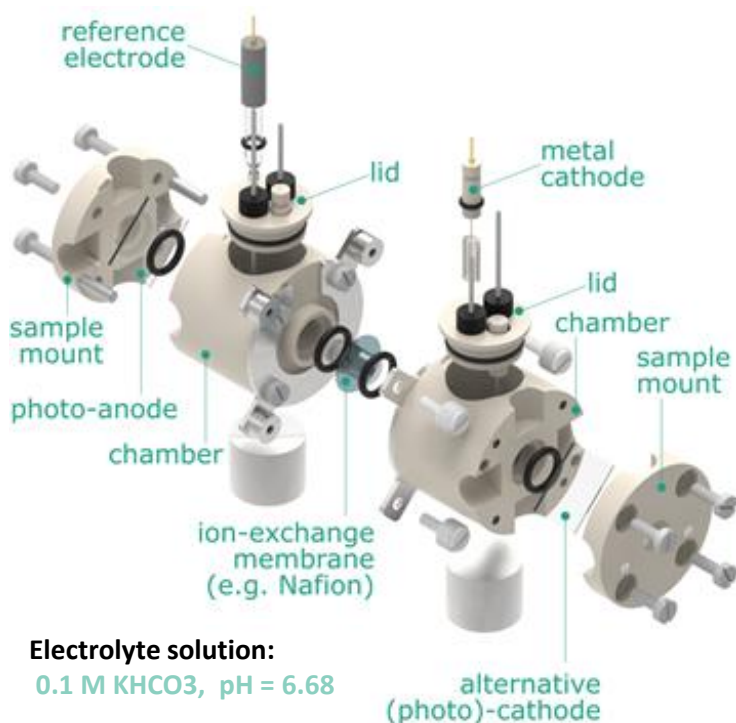


Cu nanorods



Photoelectrochemical CO₂ reduction

Photoelectrochemical cell



Photoelectrochemical characterisation of Cu nanorod catalyst

Product	Reaction	Potential (V vs SHE)
carbon monoxide	$\text{CO}_2 + 2\text{H}^+ + 2\text{e}^- = \text{CO} + \text{H}_2\text{O}$	-0.51
Hydrocarbons		
methane	$\text{CO}_2 + 8\text{H}^+ + 8\text{e}^- = \text{CH}_4 + 2\text{H}_2\text{O}$	-0.24
ethane	$2\text{CO}_2 + 14\text{H}^+ + 14\text{e}^- = \text{C}_2\text{H}_6 + 4\text{H}_2\text{O}$	-0.27
ethylene	$2\text{CO}_2 + 12\text{H}^+ + 12\text{e}^- = \text{C}_2\text{H}_4 + 4\text{H}_2\text{O}$	-0.34
Oxygenates		
formic acid	$\text{CO}_2 + 2\text{H}^+ + 2\text{e}^- = \text{HCOOH}$	-0.58
oxalic acid	$2\text{CO}_2 + 2\text{H}^+ + 2\text{e}^- = (\text{COOH})_2$	-0.87
formaldehyde	$\text{CO}_2 + 4\text{H}^+ + 4\text{e}^- = \text{HCHO} + \text{H}_2\text{O}$	-0.48
methanol	$\text{CO}_2 + 6\text{H}^+ + 6\text{e}^- = \text{CH}_3\text{OH} + 3\text{H}_2\text{O}$	-0.39
ethanol	$2\text{CO}_2 + 12\text{H}^+ + 12\text{e}^- = \text{C}_2\text{H}_5\text{OH} + 3\text{H}_2\text{O}$	-0.33
propanol	$3\text{CO}_2 + 18\text{H}^+ + 18\text{e}^- = \text{C}_3\text{H}_7\text{OH} + 5\text{H}_2\text{O}$	-0.32

