Nickel Schiff Base Complexes for Light Driven Hydrogen Production

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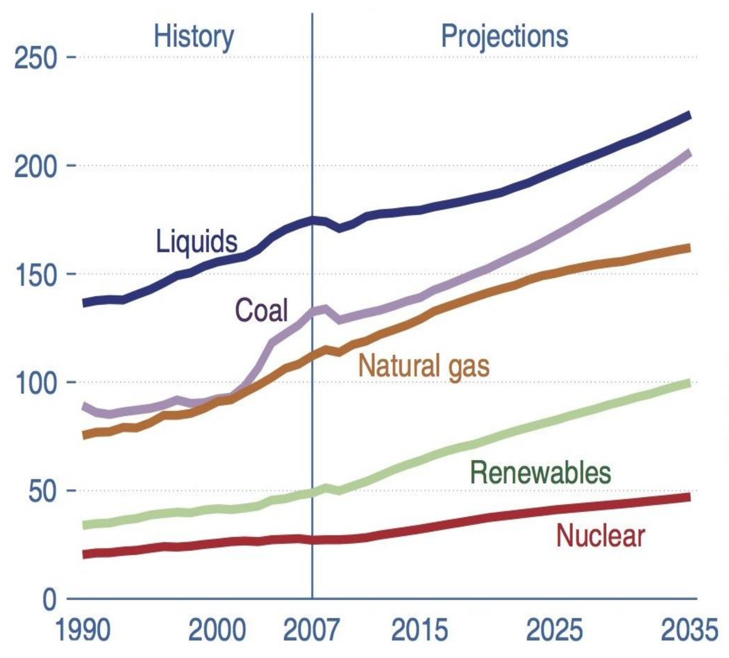
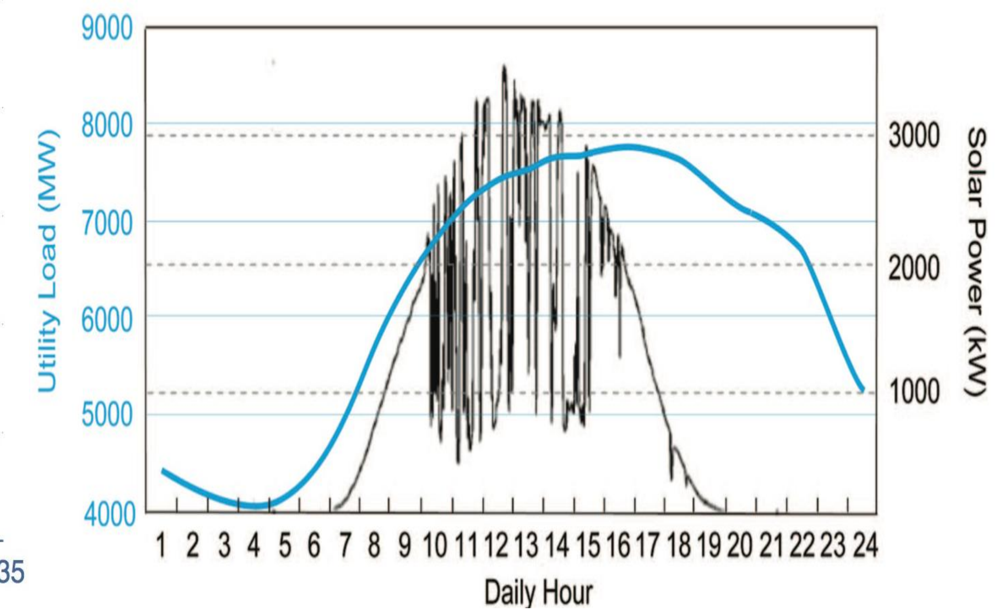
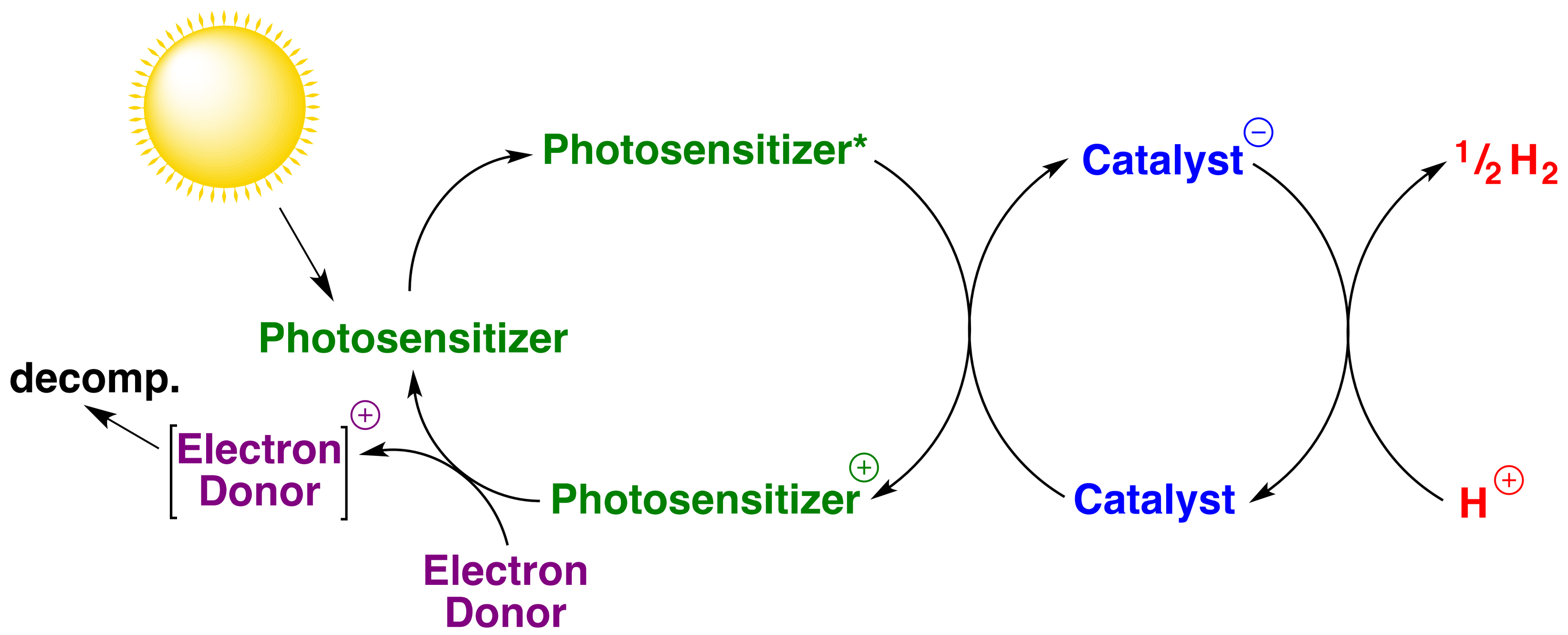
Introduction

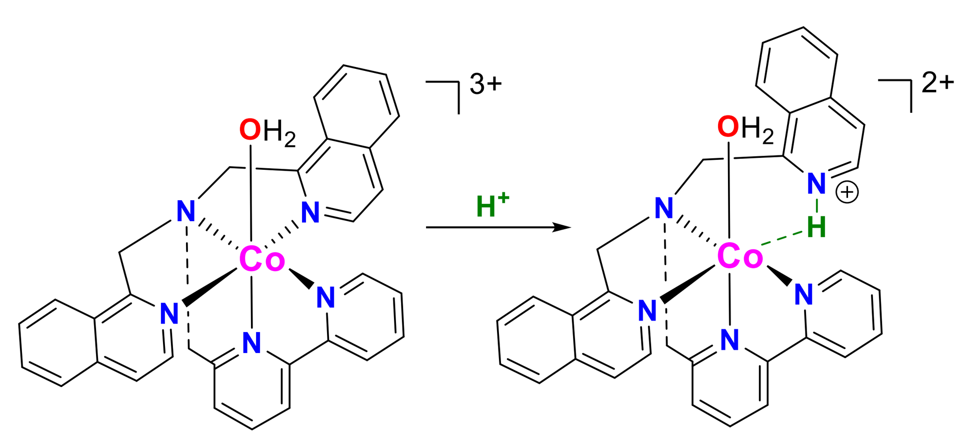
- Over the next century, the world's population is expected to drastically increase.
- By 2050, researchers predict an increase of roughly 2.4 billion, which translates to about 50% increase in energy demand.





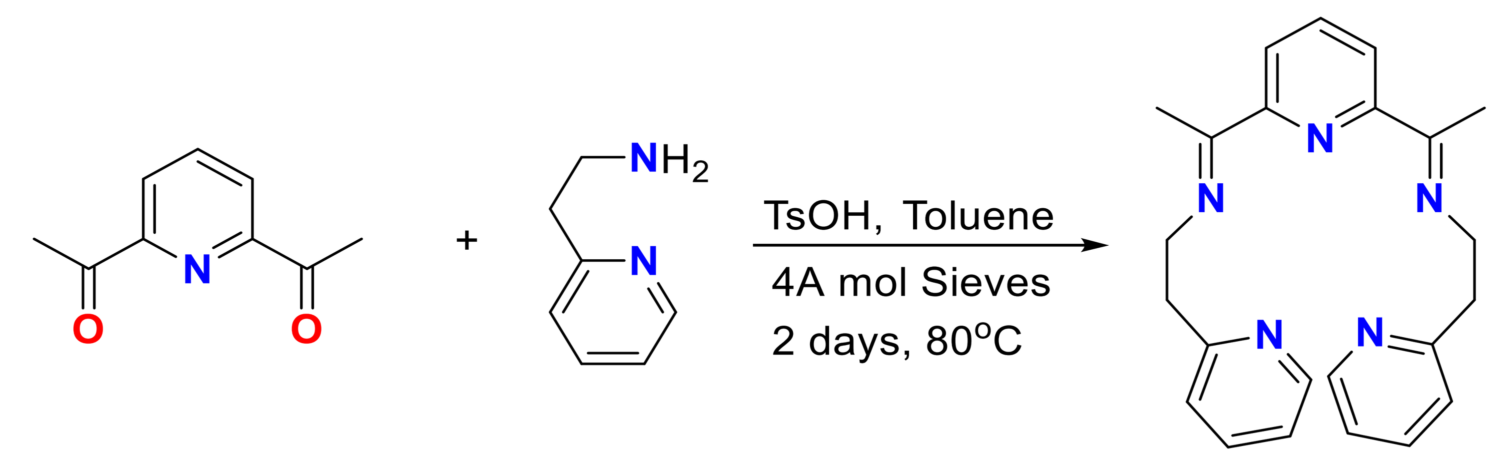
- Since utility usage continues to peak after the sun has set, it is important for researchers to investigate solar fuels as a way of storing the sun's energy.
- Solar fuels are made by converting sunlight directly into a chemical fuel, in this case hydrogen gas, which would be readily available 24/7 to produce energy.
- This project focuses on the development of homogenous catalysts incorporating abundant first row metals, such as cobalt and nickel.





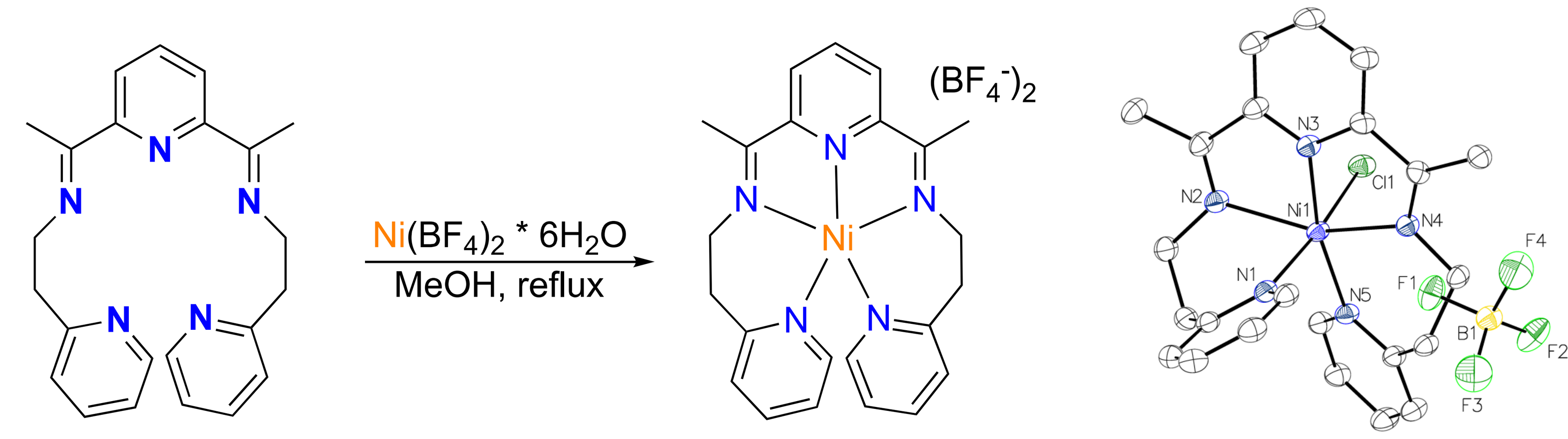
Polypyridine complexes have been shown to be highly active through the pendant base effect.

^{EtPy}PDI Ligand Synthesis

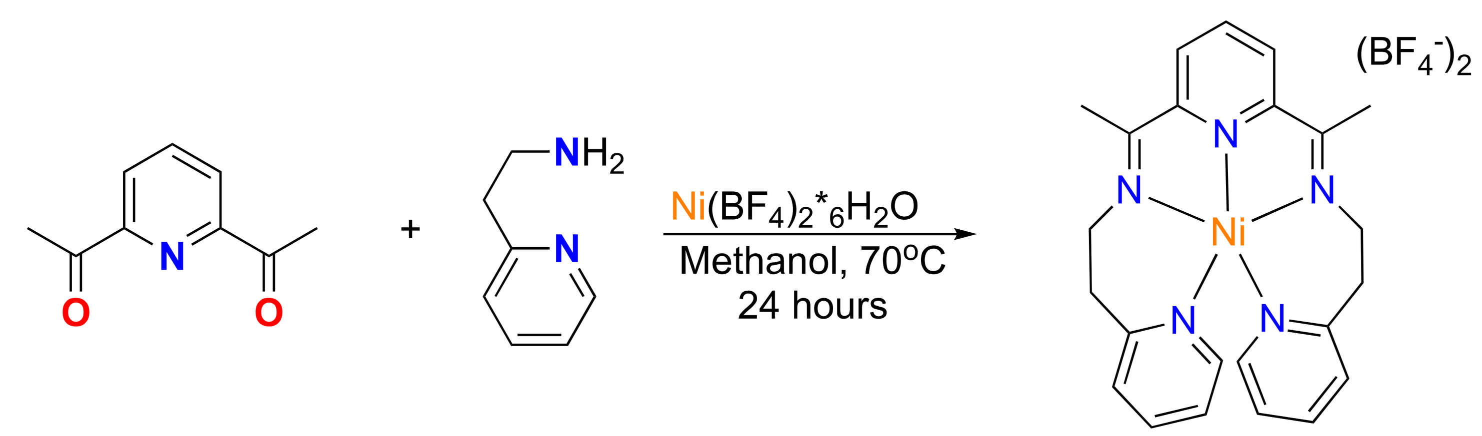


Synthesis of Nickel Complex

[Ni(^{EtPy}PDI)](BF_4)$_2$



One-pot Synthesis of [Ni(^{EtPy}PDI)](BF_4)$_2$

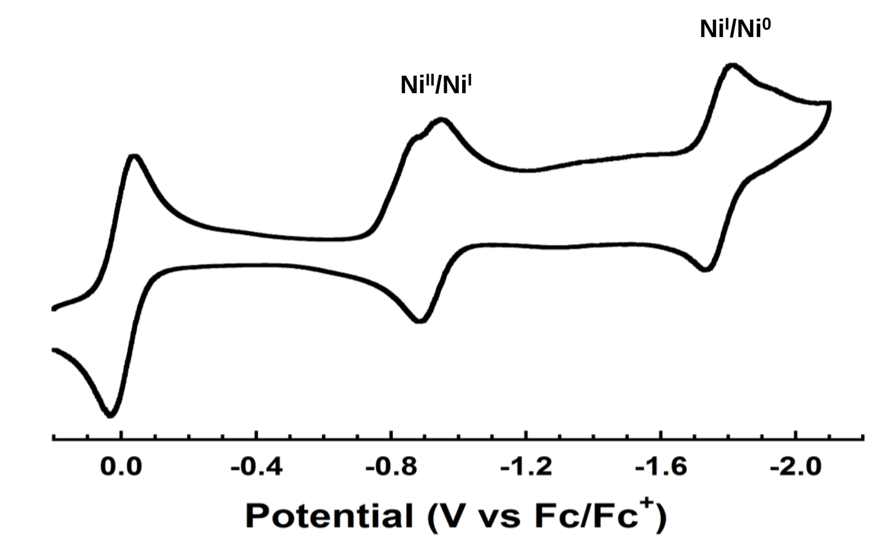


Light Driven H_2 Production

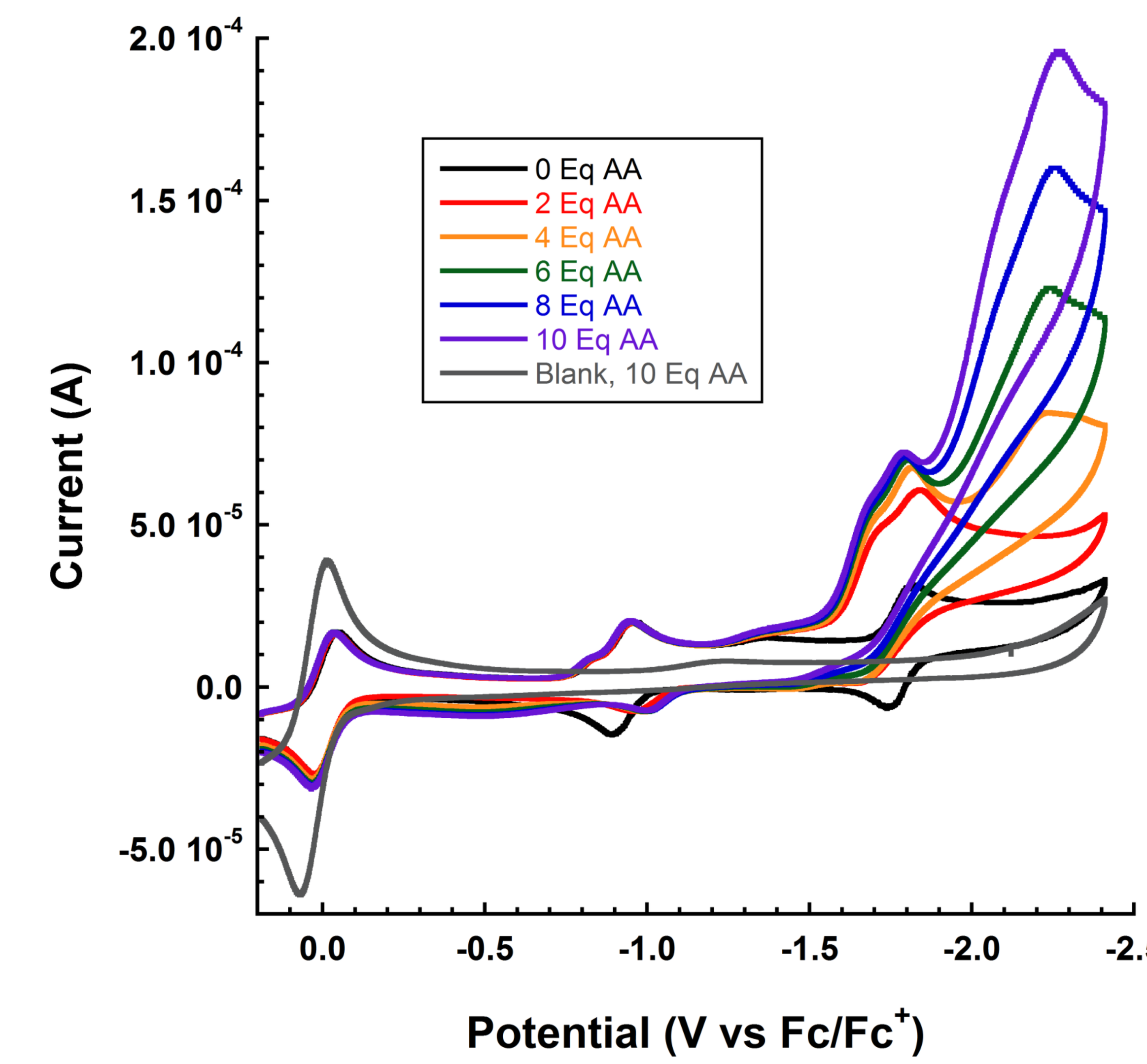
- Ni(^{EtPy}PDI)(BF_4)$_2$ was used in photocatalytic hydrogen studies.
- $(Ru(bpy)_3)^{2+}$, ascorbic acid, in a 1:1 water-acetonitrile solution at pH=4.25 using a 520 nm light source. Reaction was run for 24 hours.
- Approximately 800 TON were produced in preliminary experiments.

Electrochemistry of Nickel Complex

Electrocatalysis of [Ni(^{EtPy}PDI)](BF_4)$_2$



1 mmol of catalyst, 100 mmol of TBA-PF_6, GC electrodes, dry CH_3CN
$Ni^{II/I}$ = -0.92 V vs Fc/Fc$^+$ $Ni^{1/0}$ = -1.77V vs Fc/Fc$^+$



1 mmol of catalyst, 100 mmol of TBA-PF_6, GC electrodes, dry CH_3CN
Catalysis at -2.26 V vs Fc/Fc$^+$

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