Renewable Energy & Sustainability
Water splitting, Artificial Photosynthesis.

“Synthesis and Application of Organic-Inorganic Nanocomposites in Artificial Photosynthesis”

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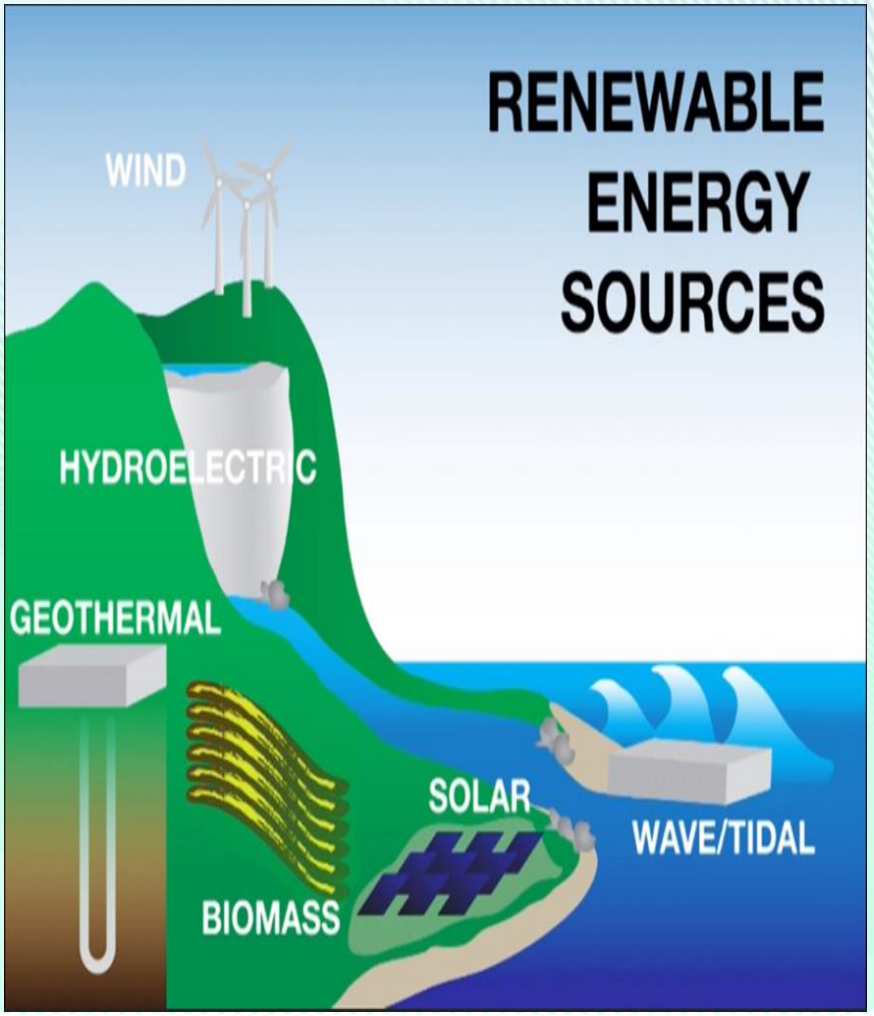
Renewable Energy

- energy that is collected from renewable resources

- energy sources that are available to utilize with acceptable efficiency

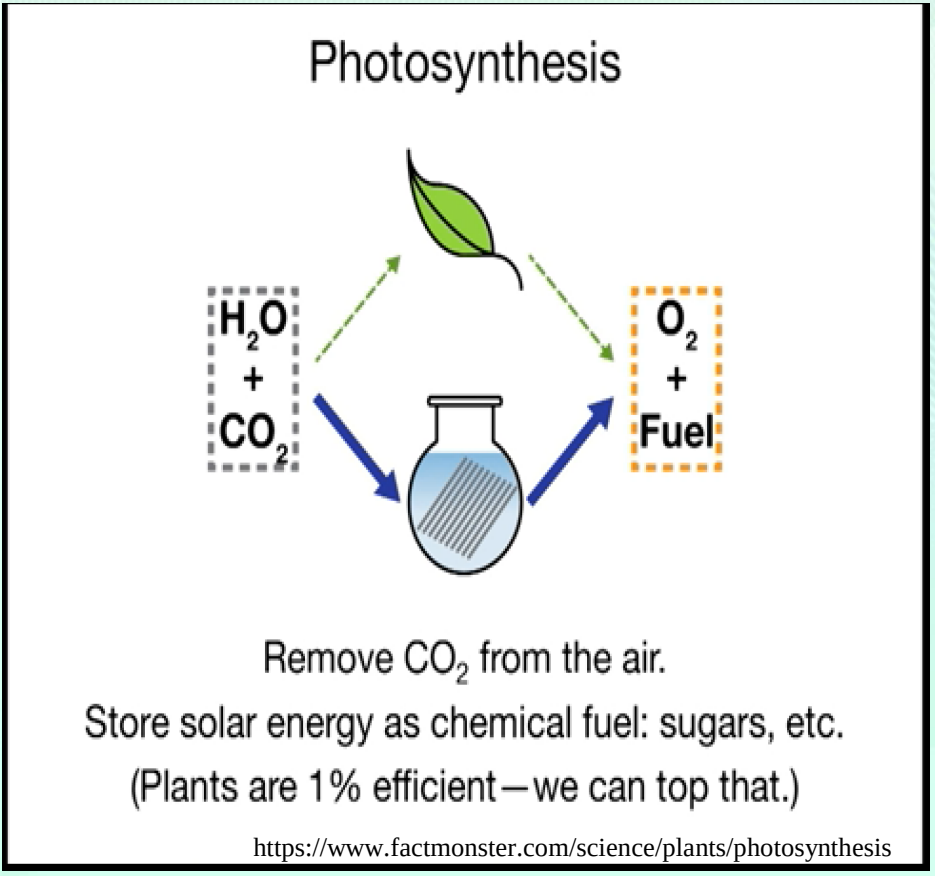
- power production with renewables
- CO_2 capturing

- Distribution?
- Storage?



Natural Photosynthesis

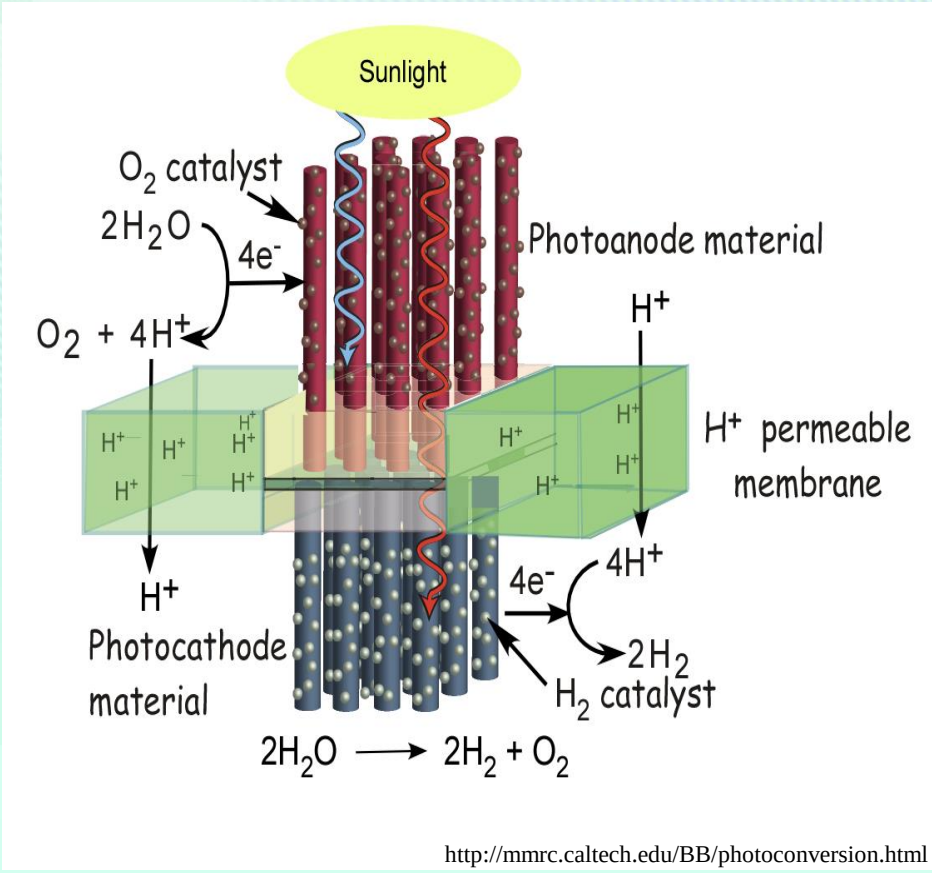
solar energy conversion into chemical fuels



https://www.factmonster.com/science/plants/photosynthesis

Artificial photosynthesis

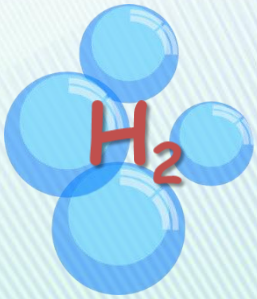
aims to emulate natural processes using man-made devices.



http://mmrc.caltech.edu/BB/photoconversion.html

Hydrogen (H_2) in the present

H_2 mainly produced from fossil resources, thus accelerates fossil fuel depletion and CO_2 emissions.



Hydrogen (H_2) in the future

- H_2, with zero carbon content, has been considered as a promising energy carrier to fulfil our need for future fuel applications.

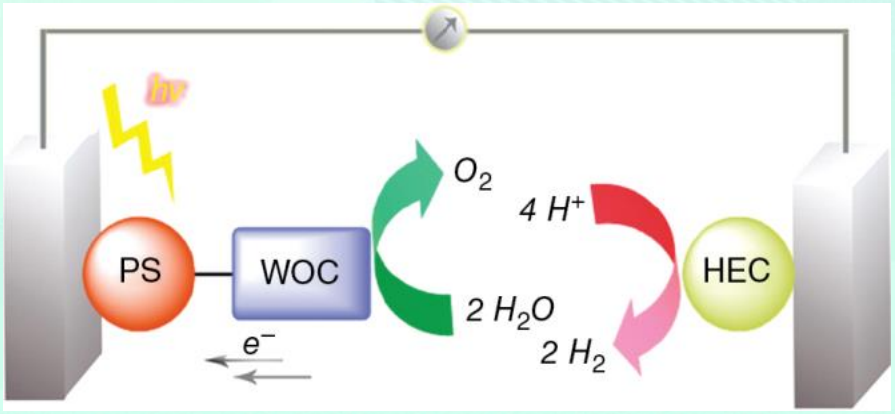
- H_2 from solar water splitting is a perfect fuel for hydrogen fuel cells or CO_2 reduction technologies

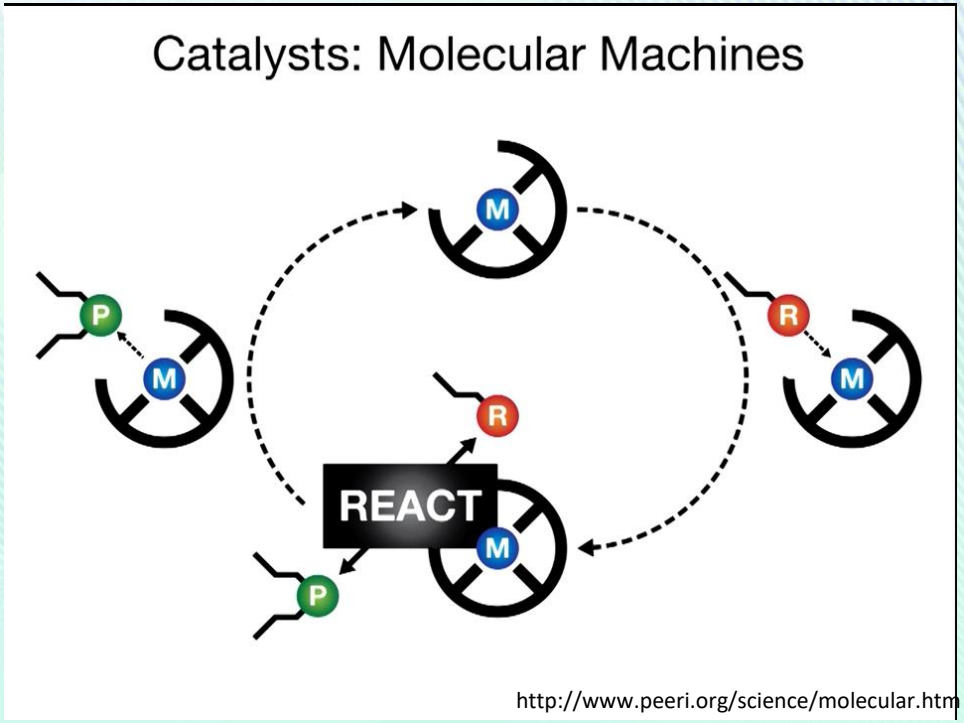
Water Splitting

- Solar overall water splitting (OWS, $2H_2O \rightarrow 2H_2+O_2$) to produce H_2 fuel is a promising approach for solar energy utilization.

Catalysis

- Catalysts play very important roles in two half reactions of water splitting:
- Hydrogen Evolution Reaction (HER)
- Oxygen Evolution Reaction (OER)





http://www.peeri.org/science/molecular.htm

Catalysis

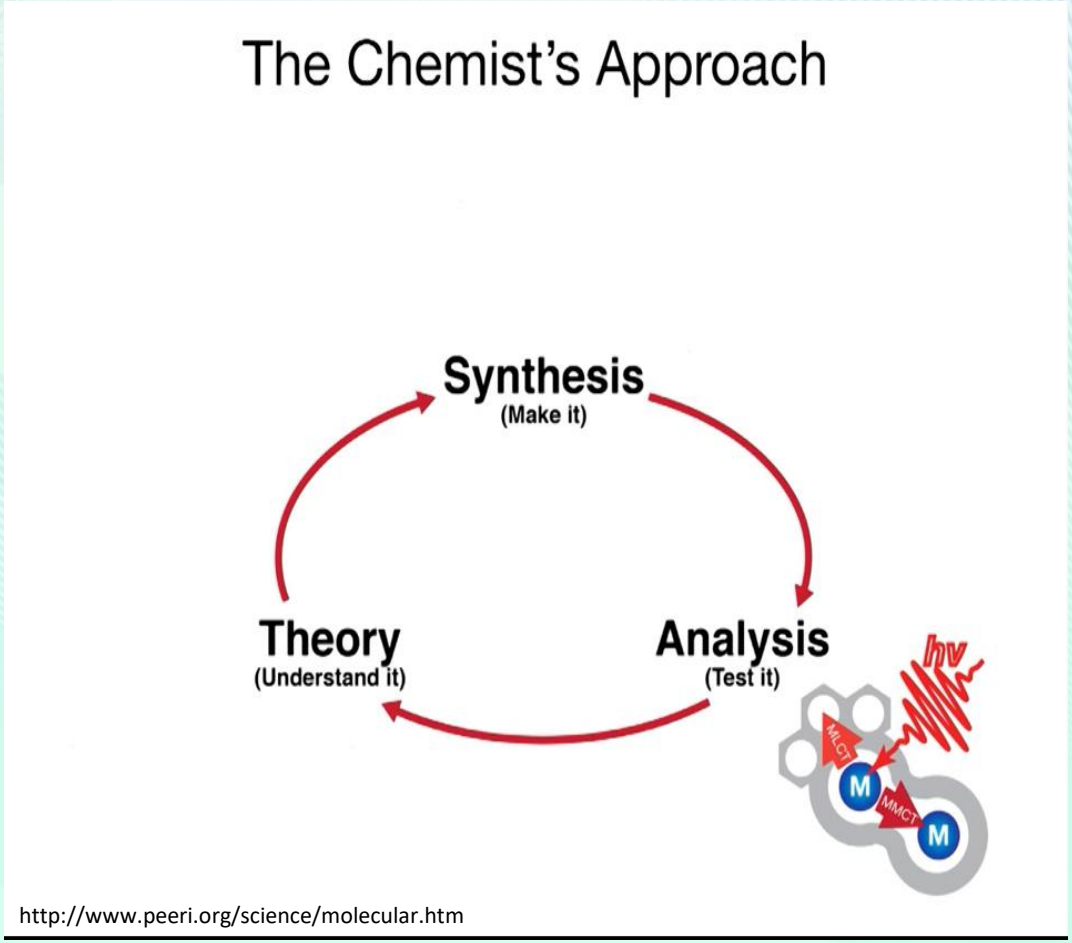
- To develop Catalyst

Two complexes

$[Fe^{III}(pbt)Cl_3]$

$[Cu^{II}(pbt)_2(OH_2)](ClO_4)_2$

*pbt is 2-(2-pyridyl)benzoxazole ligands,

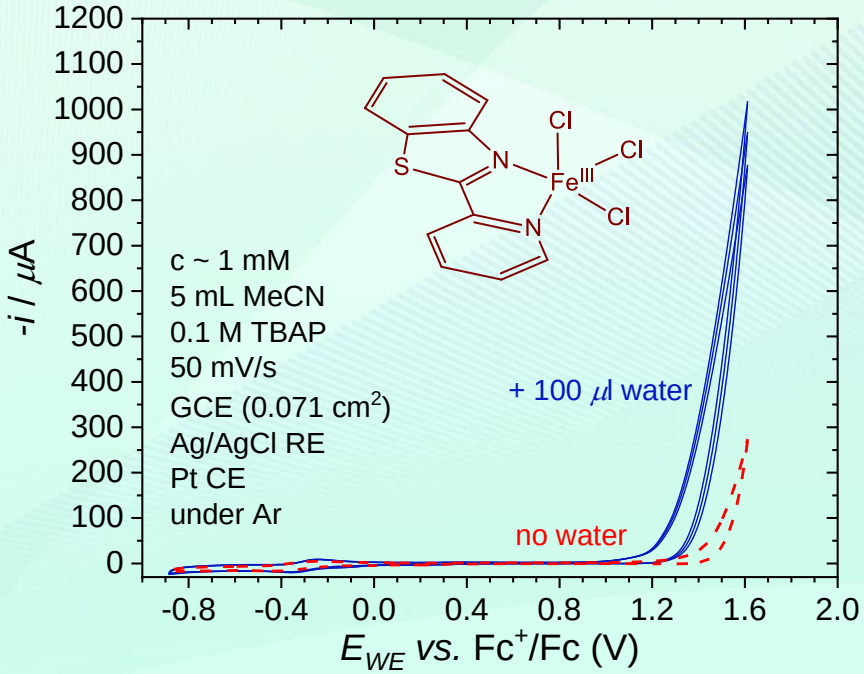


http://www.peeri.org/science/molecular.htm

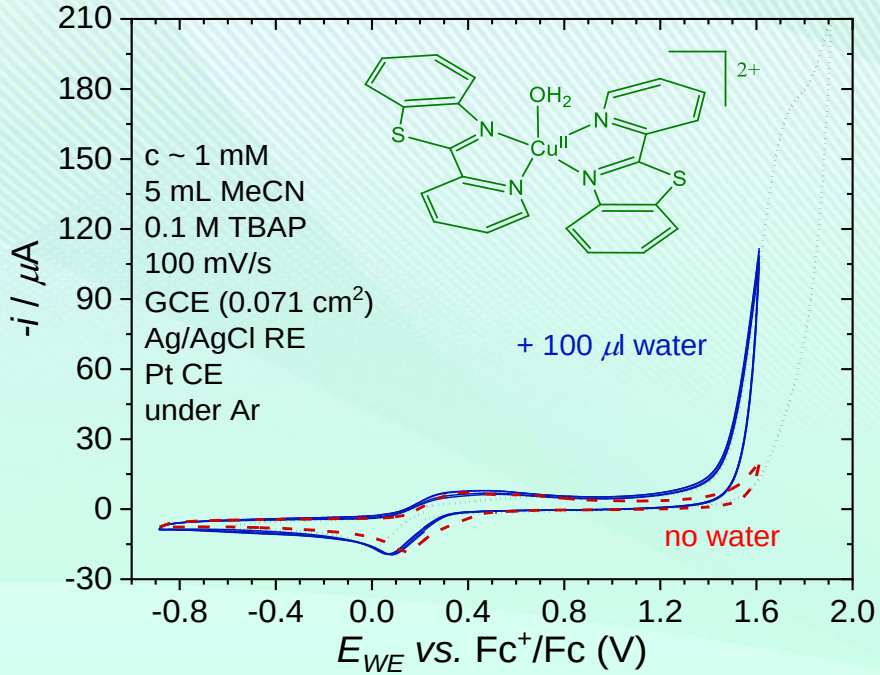
Results

Preliminary tests for the co-catalyst components of the planned hybrid organic-inorganic systems.The water insoluble complexes are tested in acetonitrile by cyclic voltammetry (CV) as shown below:

$[Fe^{III}(pbt)Cl_3]$



$[Cu^{II}(pbt)_2(OH_2)](ClO_4)_2$



Aim of the Research

- The fabrication of novel advanced photo(electro)catalytic (sea)water splitting systems consisting of the hierarchical combination of:
- Cost-effective molecular co-catalysts (i.e. first row transition metal complexes) – this is the main topic of my PhD.
- The design and synthesis of the molecular co-catalysts aims to water insolubility, long term stability, high catalytic performance capabilities, and high affinity for the semiconductor surface.

Thank You