

Fabrication of Dye Sensitized Solar Cells Using Fe-, Mn- and Co-oxyhydroxide nanocrystals in ferritin as the dye

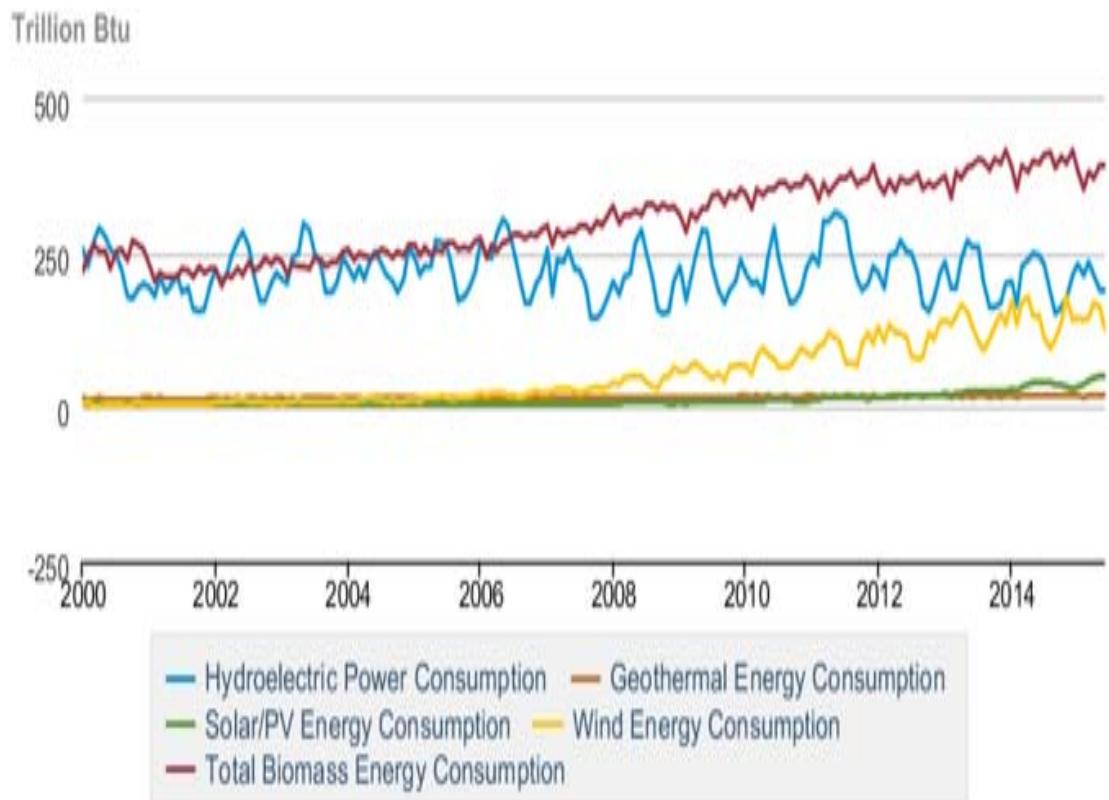
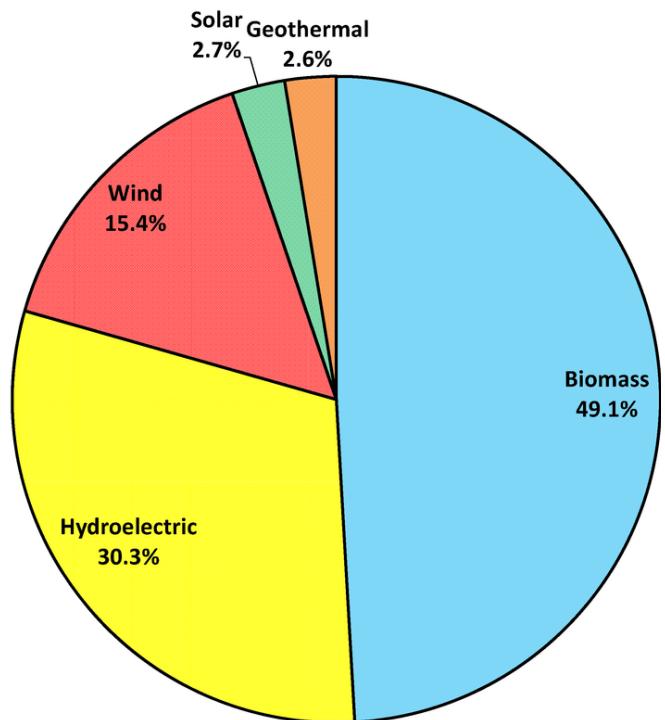
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Astronomy**

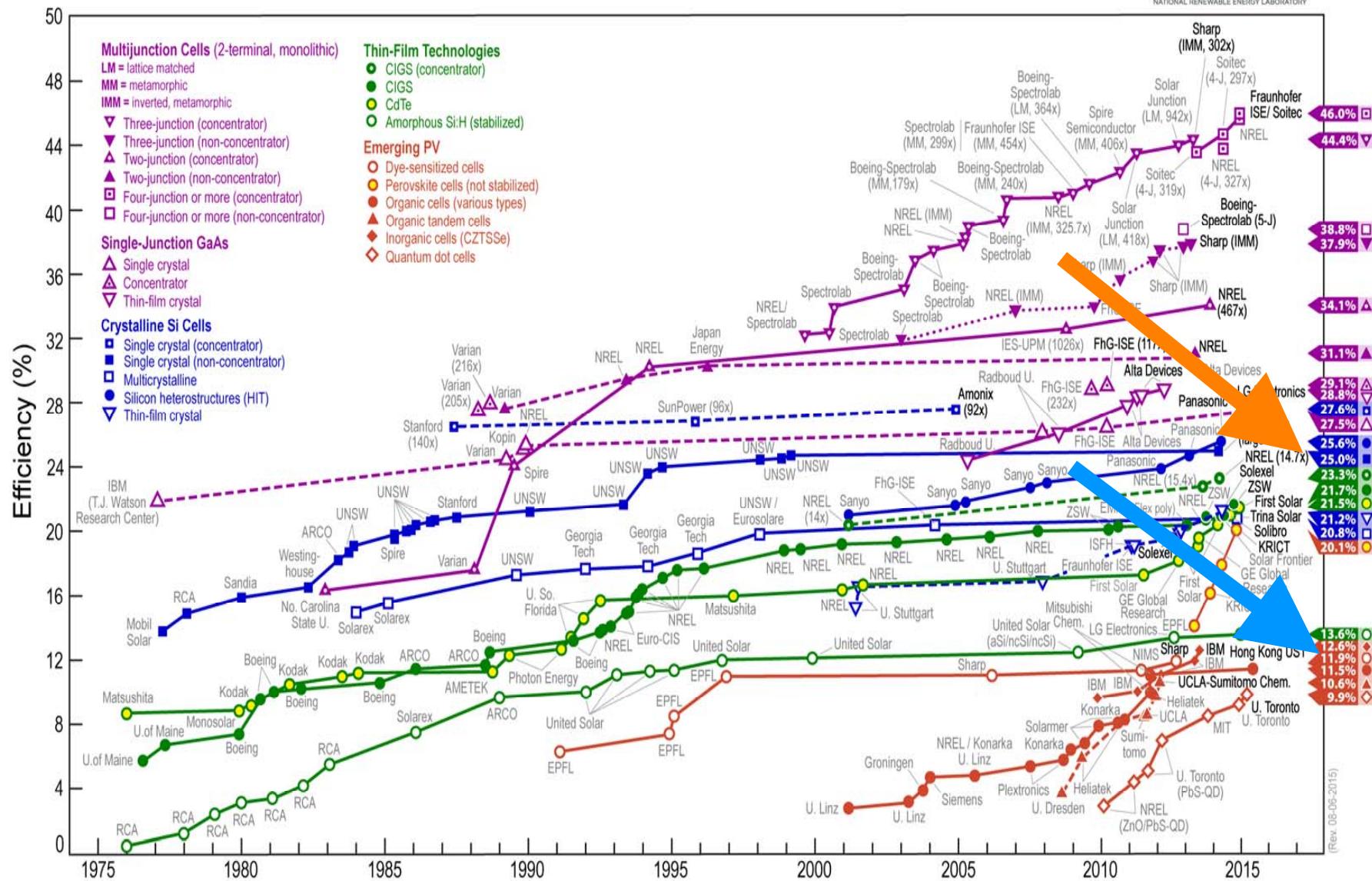


Renewable energies in the USA



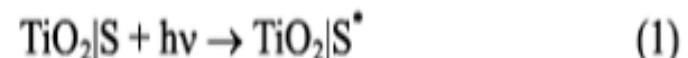
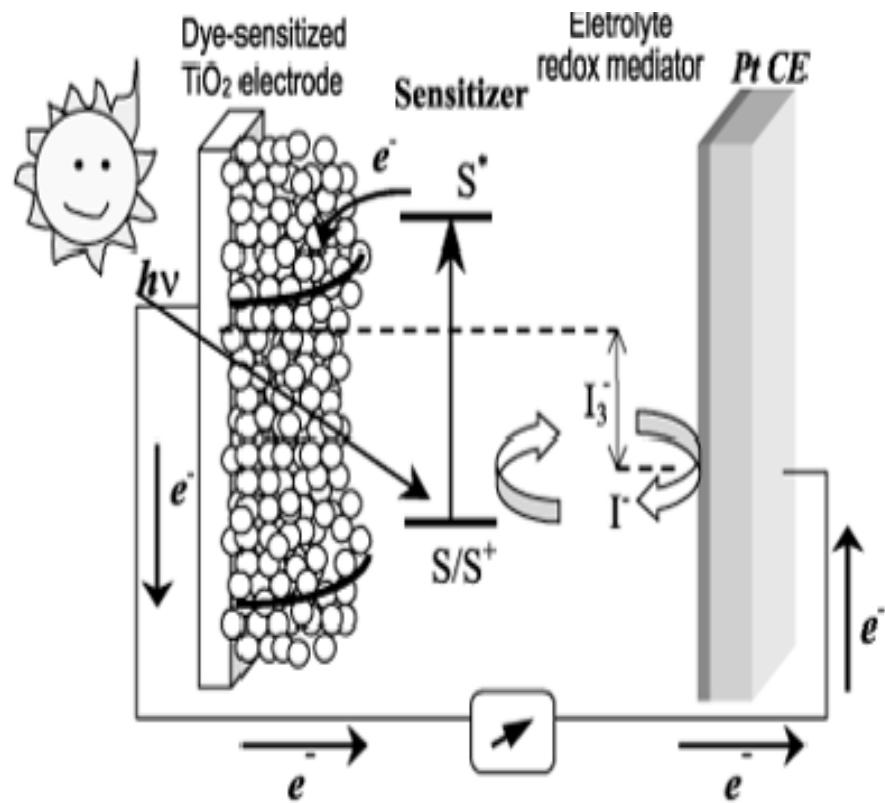
Source: U.S Energy Information Administration (EIA)

Best Research-Cell Efficiencies



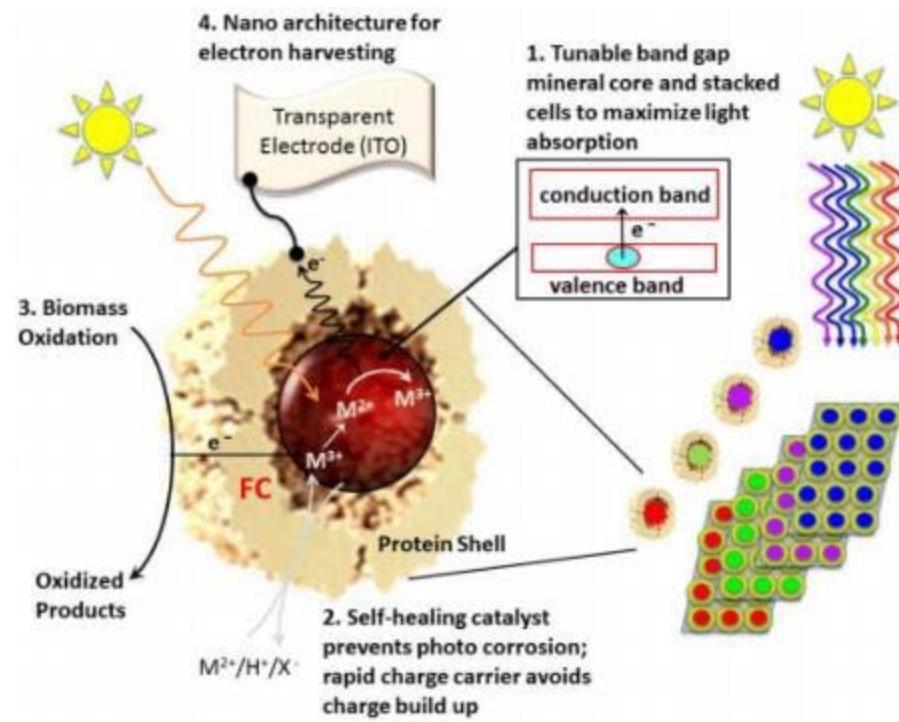
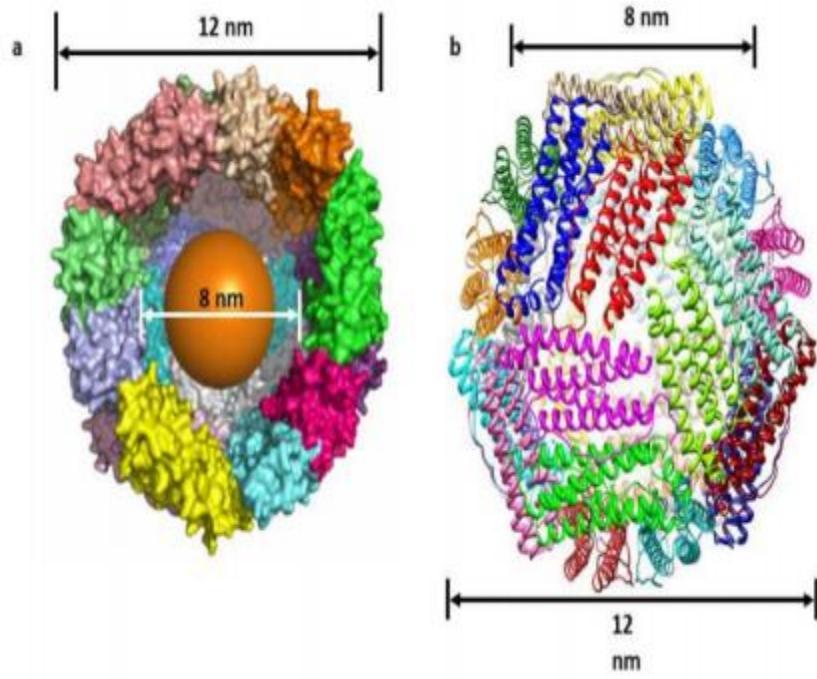
Source: http://www.nrel.gov/ncpv/images/efficiency_chart.jpg

Mechanism of Dye Sensitized Solar Cells (DSSCs)

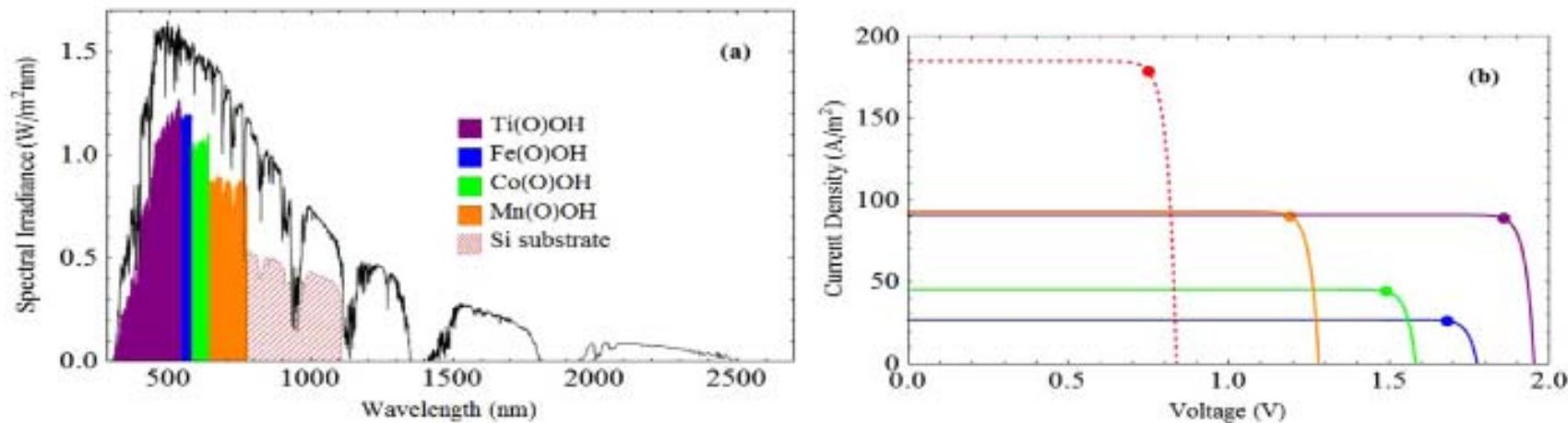


Why Ferritin?

- Different wavelengths of light can be absorbed using different nanocrystals
- Prevent photo-corrosion in metal oxide semiconductors
- Thermo-stable up to 80°C.



Theoretical Efficiency of Ferritin Based Solar Cells

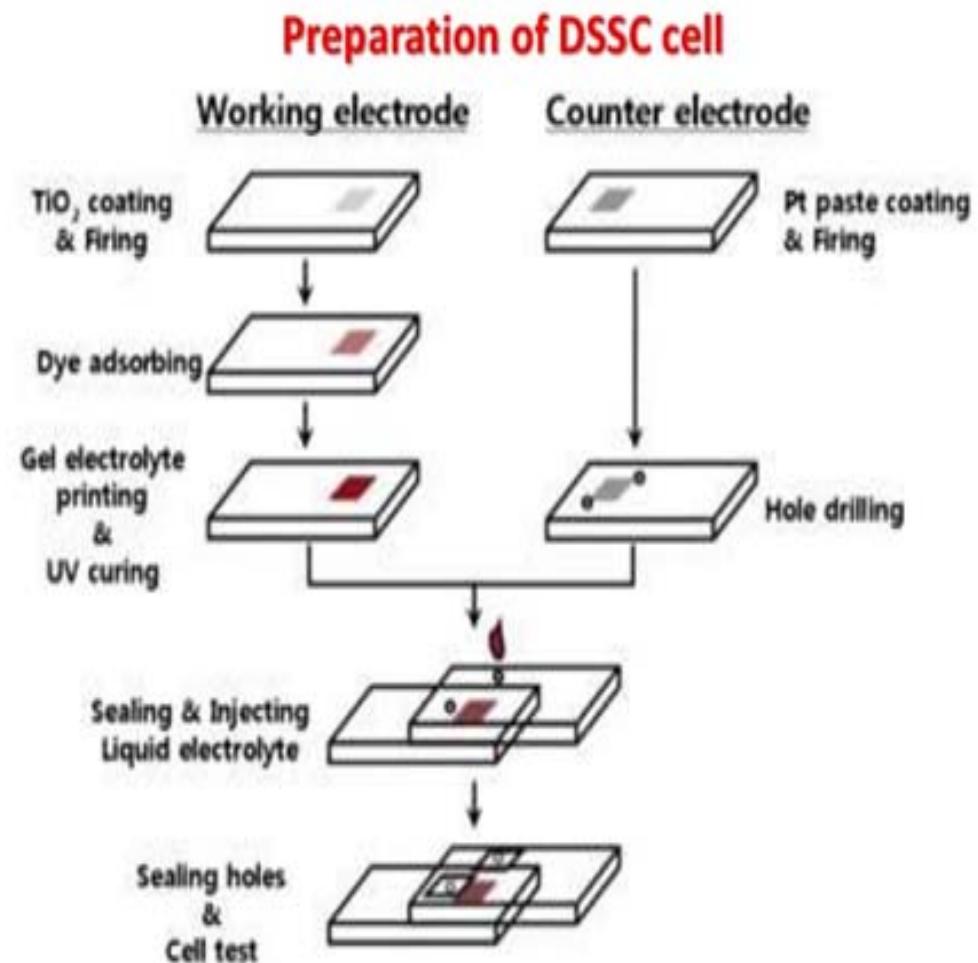


	f_O (# Suns)	Operating voltages (V)	Theoretical efficiency (%)
Ti, Fe, Co, Mn	1	1.856, 1.680, 1.490, 1.181	38.0
	100	1.974, 1.798, 1.607, 1.298	41.0
	Max	2.130, 1.954, 1.764, 1.453	44.9
Ti, Fe, Co, Mn, Si	1	1.856, 1.680, 1.490, 1.191, 0.748	51.3
	100	1.974, 1.798, 1.608, 1.308, 0.864	56.4
	Max	2.130, 1.954, 1.764, 1.464, 1.012	63.1
Ti, Co, Mn, Si (Current matched)	1	1.905, 1.505, 1.251, 0.825 (5.49 total)	41.6
	100	2.024, 1.622, 1.370, 0.944 (5.96 total)	45.2
	Max	2.182, 1.778, 1.527, 1.103 (6.59 total)	50.0

Source : Erickson, S. (2014). NonnativeCo-, Mn-, and Ti-oxyhydroxide nanocrystals in ferritin for high efficiency solar energy conversion. *Nanotechnology*, 015703-015703.

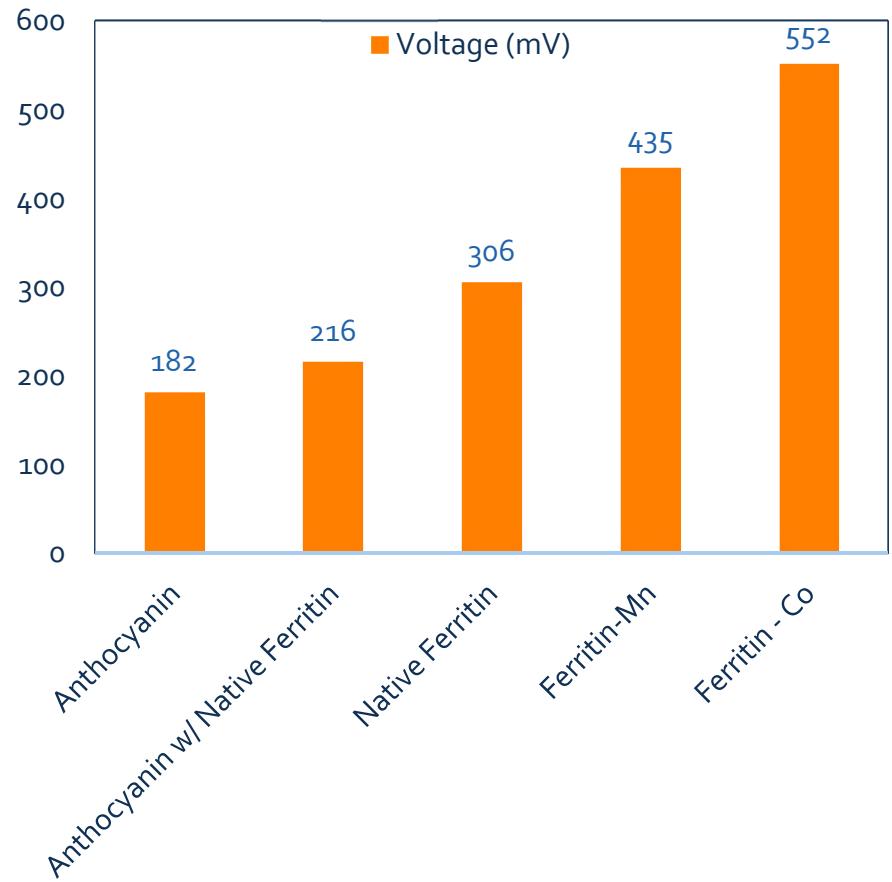
Fabrication

1. TiO₂ preparation and deposition
2. Ferritin deposition
3. Counter Electrode preparation
4. Assembling the cell and electrolyte injection



First Results

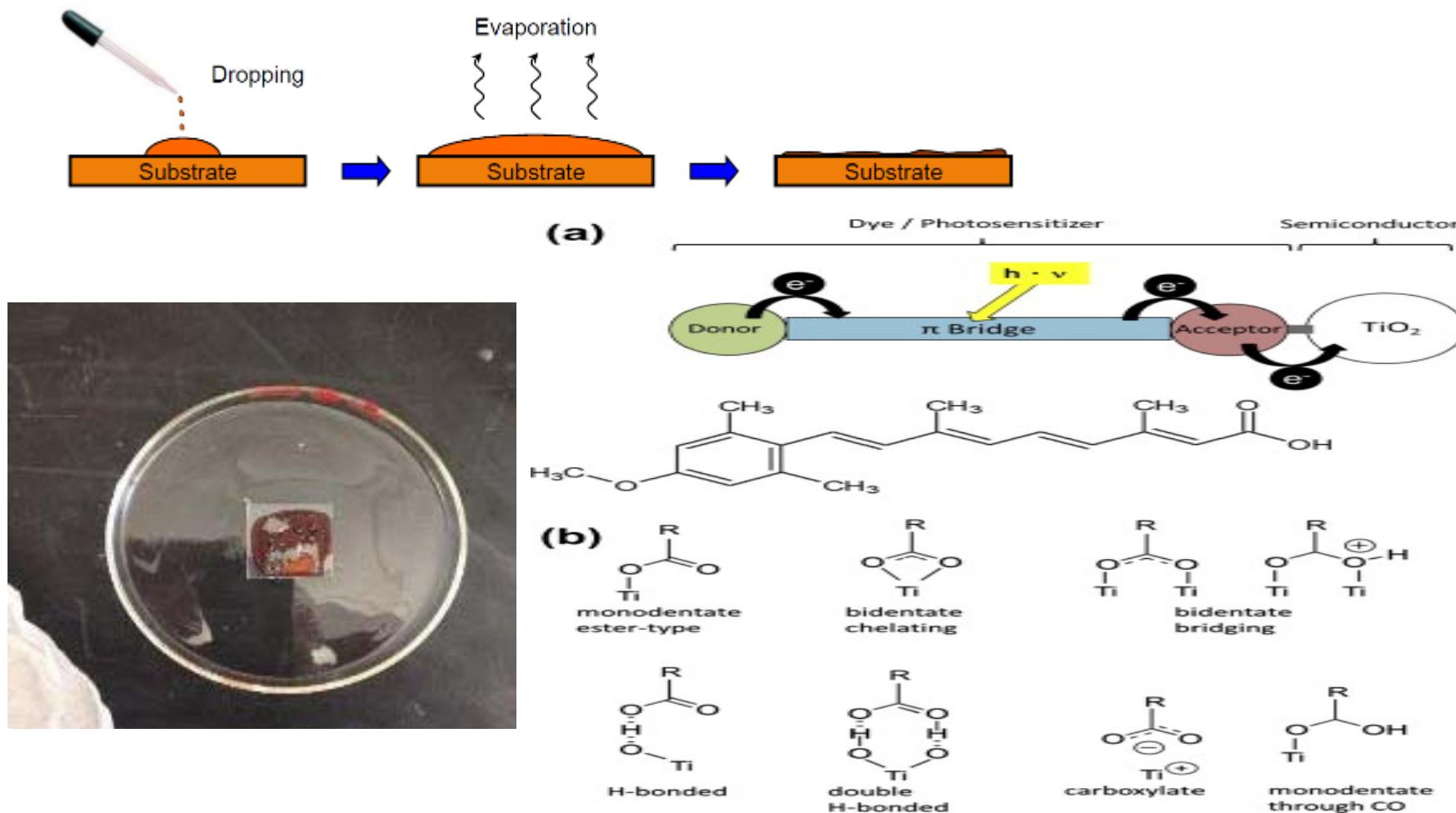
Open circuit voltage measurements of the different DSSCs fabricated.
Volume used : 2 mL – Deposition time: 97 hours



Ferritin-Mn open circuit voltage measurement

Challenges

- + Understanding the chemical and physical interactions between ferritin and TiO₂



Conclusions & future works:

- Ferritin has been used as an alternative dye for DSSCs
- Increasing open circuit voltage due to ferritin
- Need to investigate physical and chemical interactions between ferritin and titanium dioxide
- Start to develop multilayer DSSCs