Improving the S-I process

* Heat exchange to recuperate the heat
* I2 requires reaction to run at 120°C
	+ This reaction is not favorable at this temperature
* IBr can replace I2

Advantages:

* + Almost completely liquid at room T. Tmp=40C
		- Why is Tmp so low?
			* Polarity? (nonpolar)
			* Bond= weak, 248.5 pm
	+ Can reduce rxn temperature by 80C to 40C
	+ Would improve efficiency by 3-5%
		- Efficiency also increased by smaller recycle of unused reactants
	+ Should be cheaper than iodine alone

Disadvantages:

* + Necessary to separate HI and H2SO4, but this is harder to do with IBr
		- With excess iodine, HI and H2SO4 split into a light and heavy phase that can easily be separated
		- The use of IBr does not allow for this excess of iodine
	+ How do you make it?
		- Iodine+ Bromine+ high T?
	+ What happens after you use it?
		- Cycle?

High T Electrolysis

* Two methods of breaking down water:
	+ Electrolysis—uses electricity
		- Only about 40% efficient
	+ Thermolysis—uses heat
		- At 2500°C, thermolysis alone can break down water
* Higher temperature for higher efficiency
	+ Electrolysis reaction is more efficient at higher temperatures
	+ At higher temperatures, some energy is supplied as heat
		- Best to use as much heat as possible because heat is “free”
		- 800°C-900°C has been proposed for electrolysis
			* ~65% Efficient
* Proper selection of materials for anode, cathode, and electrolyte is essential
	+ Good materials are defined by:
		- Tolerance to heat
		- Conductivity/ doping ability
		- Crystal structure
	+ Currently:
		- Cathode: Nickel Yttria Stabilized Zirconia (Ni-YSZ)
		- Anode: Cermet Nickel Lanthanum Strontium Manganate (Ni-LSM)
			* Cermet=Ceramic (cer)+ Metallic (met)
		- Electrolyte: Yttria Stabilized Zirconia

References:

1. NPRE 470 Lecture, 1/27/2011.
2. International Nuclear Societies Council. "4. Thermochemical Production of Hydrogen." *Nuclear Production of Hydrogen: Technologies and Perspectives for Global Deployment*. La Grange Park, IL: American Nuclear Society, 2004. 45-67. Print.