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.