Electro-Reduction of Iron Oxide in Different Solution Media

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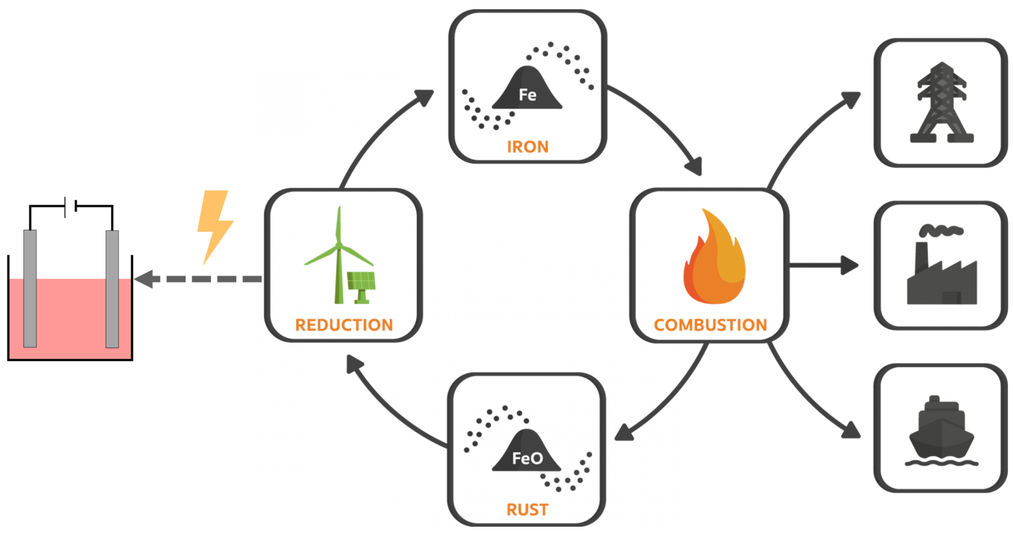
BACKGROUND

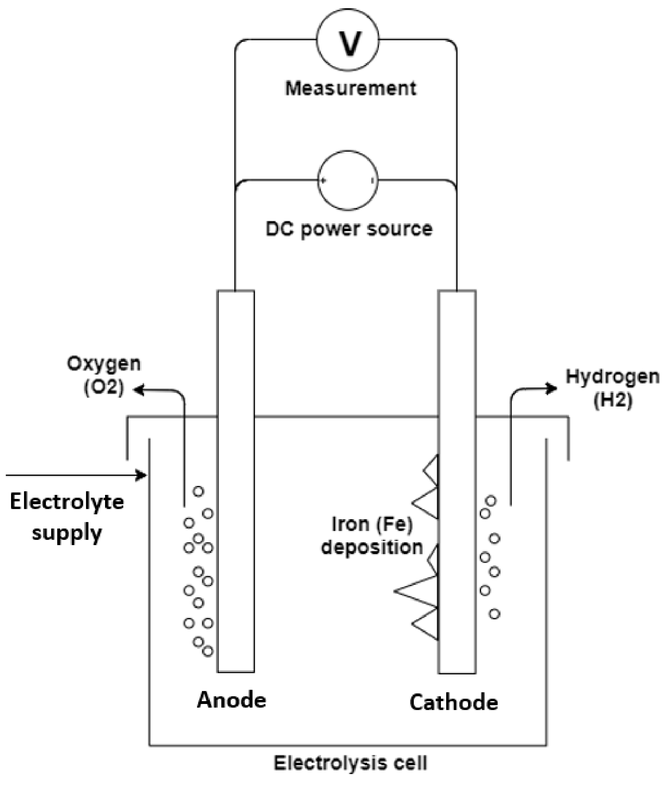
- Iron fuel: energy is generated by iron combustion and afterward the iron oxide can be collected and reduced to complete the fuel cycle.
- Thermochemical iron oxide reduction requires high temperatures; therefore, the electrochemical reduction could provide a more energy-efficient alternative.

<u>Goal</u>: To demonstrate the feasibility of low-temperature electro-reduction of iron oxide in different solution media



Iron fuel cycle concept [1]

EXPERIMENTAL SETUP



Schematic diagram of single batch parallel plate cell

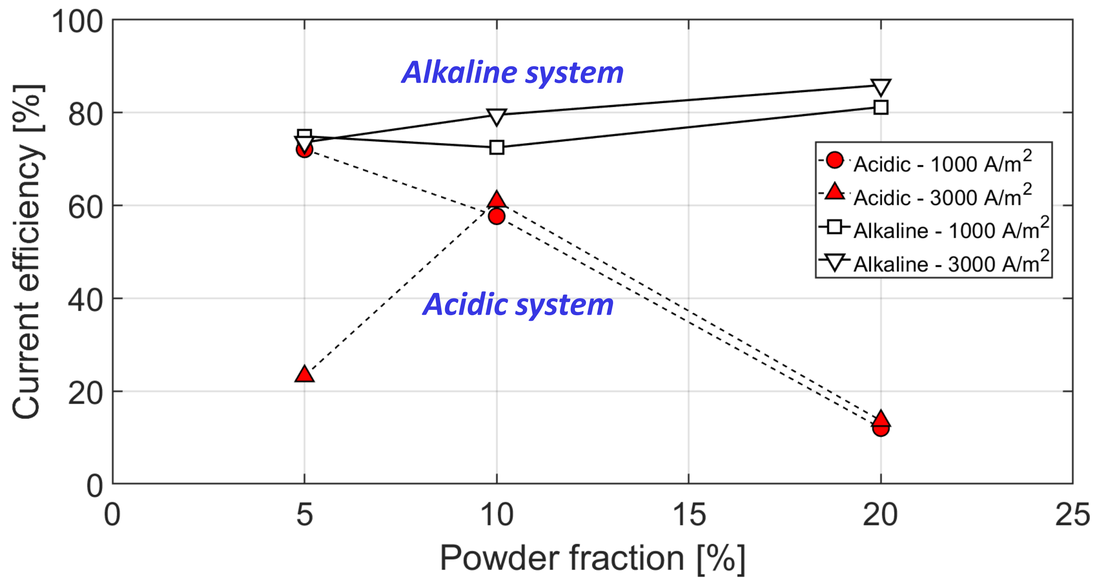
Current efficiency:

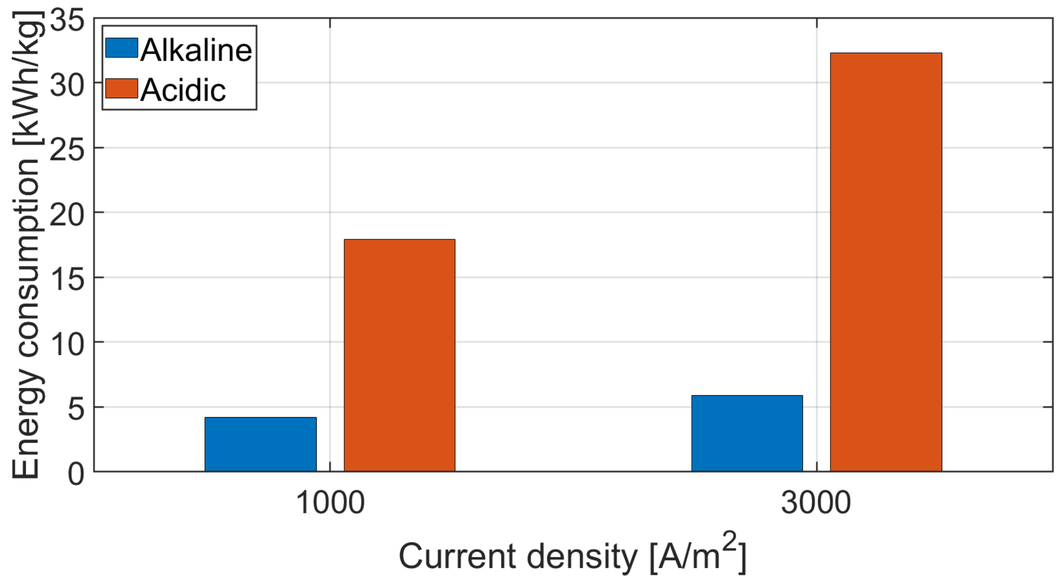
$$\eta_{current} = \frac{m_{real}}{m_{faradaic}} = m_{deposit} \cdot \left(\frac{n \cdot F}{M \cdot I \cdot t} \right)$$

Oxidation number; Faraday constant; Molar mass iron; Current supply; Duration

RESULTS AND DISCUSSION

Obtained deposit and microstructure taken from acidic (A) and alkaline (B) systems. SEM-EDS measurement shows 81.9 wt% and 97.5 wt% of iron purity, respectively.





CONCLUSION AND OUTLOOK

- Compared to the acidic system, the alkaline system shows more attractive results for the application of low-temperature iron oxide electro-reduction.
- Non-aqueous Deep Eutectic Solvent (DES) electrolytes will also be further investigated, considering their properties.

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<u>Sources:</u>
[1]: Team solid (2022); https://teamsolid.org/our-solution