Brief Motivation

- Green hydrogen has the potential to be the enabler of transition to sustainable energy.
- According to Paris Agreement, by 2050 try to reduce CO₂ emission and reach net zero. Hydrogen is one of the renewables as one of the replaceable energy.
- Hydrogen produced via electrolysis can result in zero GHG emissions.
- Hydrogen fuel have more energy by weight by volume, and hydrogen fuel storage by compressed at high pressure than ethanol.

Methodology

- In the first phase, design of flow patterns will be modelled and configured using SolidWorks software.
- In second phase i.e. the simulation phase all the parameters that have been designed will be verified using Computational Fluid Dynamics software like Ansys Fluid Flow Fluent.
- Simulation allows better understanding of factors like velocity distribution throughout the configuration, pressure distribution, temperature of the flowing fluid (here, in this case, water), losses due to friction and pressure, turbulence inside the grooves, etc.
- In the third phase simulated model will be prototyping using Polymer printing in the 1:1 ratio which will allow better grasp on the model.
- In the next phase, after validating all the parameters final material for the actual model will be selected. And after deciding tolerances it will be getting ready for fabrication. Once the fabrication is done, then all the parts will be assembled and again tested for tolerances and other parameters.

Expected Results

- The production of hydrogen increases as the area exposed to water flowing inside is increased. Good water management and handling of water flow which allows better splitting of water.
- Though PEM electrolyzer stack configuration is costlier at small scale than alkaline electrolyzer but is almost half compared to Solid Oxide Electrolyzer (SOEC) can produce pure hydrogen, but it costs too high.
- Green Hydrogen production via electrolyzer results in low energy consumption which will be suitable for industrial applications.

Expected Outcomes

- Highly dynamic control enables ideal combination with renewable energy sources.
- Limit oxygen permeation towards the hydrogen side.
- High pressure and high temperature electrolyzer water splitting with high performance at a low cell voltage and long-term stabilities.
- In order to maximize the cell stack interface, eliminate a gap between the electrolyzer components, and will provide high energy efficiency.
- A low-cost, large-scale water splitting system may be used as a proof of concept for practical applications in the storage and use of renewable energy.

References


