

Abstract – Key Research Aspects of Green Hydrogen Production

Hydrogen is considered a most promising pathway to go to meet emission reduction targets. According to the Paris agreement, climate warming should be limited by about to 2 °C by the year 2100. This means in practice that the whole energy sector including electricity and heat, transportation, industry, and agriculture sectors should have almost net zero emissions by the year 2050. Renewable electricity-based hydrogen will be the main raw material for emission free hydrocarbons. The amount of renewable hydrogen generated is therefore expected to radically increase. Renewable electricity-based hydrogen will be the main raw material for emission free hydrocarbons. Hydrogen is needed in steel industry as replacement for coking coal in the process, in the future food production, to produce carbon neutral fuels for transportation, raw materials for the chemical industry, and as well as seasonal energy storage. Water electrolyzers will have a key role to play in this development. The hydrogen generation rate of a water electrolyzer is directly proportional to the mean value of the DC current supplied to the electrodes, and thus, the cost of electricity is the main contributor to the cost of electrolytic hydrogen gas. Hydrogen generation should also be dynamically flexible, because green hydrogen generation will be based on low price and emission free, new electricity generation that means in practice solar and wind power.

In general, the presentation focuses on those water electrolysis research topics that can have the greatest impact on reducing the costs of green hydrogen in the future. The main topics are: (1) Alkaline water electrolyzer (AWE) technology plays a key role in industrial scale-up, (2) the role of power electronics, (3) AWE is considered a mature technology, but there is a lot of development and research that is not widely recognized, (4) dimensioning of green hydrogen production plants.

Keywords

Water electrolysis, green hydrogen, renewable electricity