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A REVIEW OF GRAPHENE APPLICATIONS IN GREEN HYDROGEN PRODUCTION

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Abstract

Green hydrogen has gained prominence worldwide in the strategies and public policies that pursue carbon neutrality by 2030, due to the opportunities it presents for its use. In its place is followed by graphene, being a material of great interest to the scientific community due to its extraordinary thermal, optical and mechanical properties, in addition to the abundance of carbon in nature, these properties allow us to build the best catalysts to generate hydrogen. The possible applications related to green hydrogen present great challenges for its implementation due to the high costs and the difficulties in its management.

What is green hydrogen?

Green hydrogen is the name used to identify hydrogen produced for renewable sources by electrolysis.

For the production process:Electrolyzers come in a variety of sizes, ranging from compact, appliance-sized units suitable for small-scale decentralized hydrogen generation to large-scale central facilities that can be directly integrated with renewable or emissions-free electricity generation sources.

Hydrogen has taken relevance worldwide in the economic strategies and public policies that seek carbon neutrality by 2030.

ALKALINE ELECTROLYSIS

- **Advantages**
  - This method is widely used and commercialized.
  - Uses Nickel and iron based electrodes and produces hydiogen in the scale of megawatt
- **Disadvantages:**
  - Lower gas purity
  - Lower operational pressure
  - Higher energy consumption

POLYMER EXCHANGE MEMBRANE (PEM)

- **Advantages**
  - Widely used in fuel cells for electricity generation
  - Excellent chemical stability
  - high ionic conductivity
  - Works at low temperature during high levels of relative humidity
- **Disadvantages:**
  - Operating at a lab scale capacity (10-100kW)

SOLID OXIDE ELECTROLYSIS CELLS (SOEC)

- **Advantages**
  - Works at higher temperature (comparing with other systems(
- **Disadvantages:**
  - Poor long term cell stability

Graphene is an allotrope of carbon and is considered as the building block of all graphitic material[1], is a two-dimensional structure with hexagonal shape and has unique physicochemical prope
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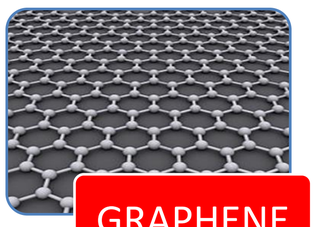

GRAPHENE

GENERAL PROPERTIES

The thinnest material[2].

- Electron high mobility[3]
- High surface area / mass ratio (2600 m^2/g)[3]
- Strength (Young modulus 1.0 TPa)[4]
- Highest thermal conductivity (5.3 $x10^3 WmK^{-1}$)[3-5]
- Impermeable to gases[1].
- Highly transparent (absorbs about 2% in the visible).

Conclusion

In Dominican Republic so far there is no direct policy that includes the production and management of green hydrogen, LFortran in Jupyter Kernel has been used to build a simple model based in Efficiency indicator for hydrogen production cost made by Y. -S. Huang and S. -J. Liu (North China Electric Power University)[6].The equation was modified adapted to the Dominican situation Calculated costs range from $5.57-6.69 per 1kg of hydrogen depending on the electrolysis system if the dollar was 1 dollar = 53.79 Dominican peso , that is a quite high price considering that storage and transportation were not calculated. For the interesting properties of graphene, the use of this material can be considered for storage applications, and even a new method for produce green hydrogen without using water. For this, further work should be done.

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