Printed Technologies For Green Hydrogen Production & Conversion
(Century Gothic 15)

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Abstract (Century Gothic 11)
It is expected that within the next years, and strongly endorsed by the European Green Deal, renewable energy sources such as solar and wind will dominate the energy system along with green hydrogen gas (H_2) as an energy carrier[1,2]. Green H_2 produced from water electrolysis powered by renewable energy sources is one of the most wanted technologies for a net-zero scenario. Proton exchange membrane (PEM) presents several advantages in fuel cells for mobility applications and is expected by some authors to be dominant also in water electrolysis in the market by 2030[3,4]. However, at present, the large-scale implementation of PEM technology presents high costs, being most of the research efforts focused on replacing noble-metal catalysts with earth-abundant materials and non-halogenated membrane materials. Another strategy to reduce costs is through simplifying the assembly steps complexity allowing the up-scaling through high-volume manufacturing processes[5]. In this scenario, printing methodologies present a key advantage to PEM technology, due to their low cost and high throughput, and ideally, their use may be extended to more components than just the catalyst layer in the membrane electrode assembly (MEA). Recently, reports of spray coating, inkjet, and screen printing have been reported in the deposition of catalyst layers and membranes for PEMWE and H_2 fuel cells and are here presented and analysed[6,7] The research study presented focuses on the identification and analysis of the state of the art about use of printing techniques in the preparation of components for PEM technology (electrodes, catalyst layer, membranes, and MEAs) (Fig.1). The study concerns the analysis of the system about applications, materials used, printing techniques employed in manufacturing, type of device and performance. Finally, the electrochemical performance and stability of the partially printed MEAs in single-cell and cell stacks are compared against comparable MEAs using normal assembly techniques. Estimation of cost reduction using printing techniques in selected systems. The viability of partially printed components and MEAs for room temperature PEMWE is demonstrated through analysis of cost estimation and figures of merit comparing the electrochemical performance at a certain mA/cm^2 with conventional comparable MEAs.
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References

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Figures

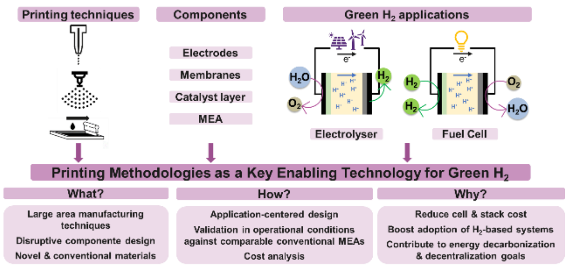

Figure 1: Schematic representation of the research study applied to printed methodologies applications to green hydrogen field.