Design of laser-induced graphene electrodes for water splitting

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Hydrogen production has become an attractive alternative for clean energy due to its high calorific value, meeting the increasing worldwide energy needs. However, the most common hydrogen production route is still from fossil fuels, provided by low cost and high hydrogen production rates. Water electrolysis is gaining attention as a greener H_2 production route, with the possibility of being powered by renewable energy systems. Therefore, efficient energy storage from intermittent renewables can rely on the conversion of temporary energy excess by alkaline electrolysis, yielding oxygen and green hydrogen, which can be stored and used on demand.

Electrodes made of laser-induced graphene (LIG) materials emerge as an alternative to the traditional electrocatalysts, originating from a laser-scribing process on carbon-based substrates using a laser with wavelengths spanning from UV to mid-IR regions. LIG offers many advantages over the traditional graphene processing routes, due to inherent simplicity, low cost-benefit and ease of scalability to mass production.

LIG electrode performance towards water splitting in alkaline media was evaluated as a function of the laser processing parameters. Promising guidelines were obtained for hydrogen production through the favourable formation of high structural quality multilayer graphene with uniform porous microstructures, showing high electrochemical activity and promising hydrogen evolution reaction (HER) performance.

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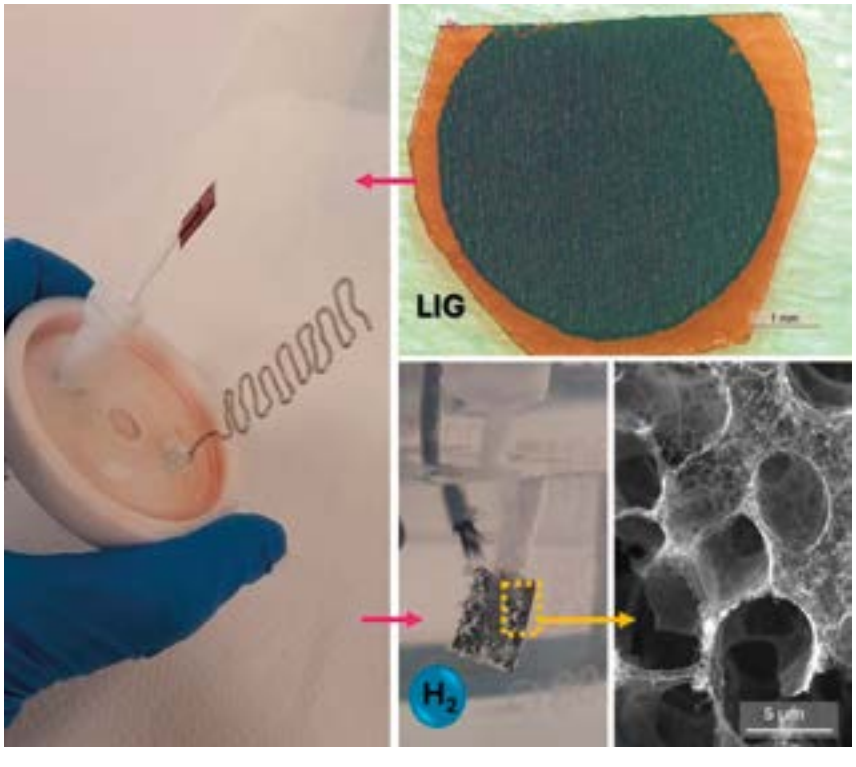

FIGURE 1
Scheme of the electrochemical cell and LIG electrode configuration with an image of three-dimensional and porous LIG microstructure.