Laser-nanostructured electrodes for enhanced Hydrogen Evolution Reaction

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We present the laser-assisted fabrication of periodic nanostructures on Nickel sheets and their use as cathodes in alkaline electrolysis (Fig. 1). We found that it exhibits enhanced electrochemical values and 3.7 times larger hydrogen production efficiency in comparison to untreated Nickel sheets. In a second step, further electrodeposition of nickel particles was performed. The resulting electrodeposited-laser-nanostructured (ELN) electrode exhibited further increased hydrogen evolution reaction activity and further improved electrochemical characteristics. Scanning electron microscopy (SEM) revealed a dendrite-like morphology for the ELN electrode surface. Thus, the enhanced activity has been attributed to the concomitant enlargement of the electrode's electrocatalytic area. The ELN electrode was measured to produce almost 5 times more hydrogen gas than a flat Ni electrode.

Three dimensional electrodes have been also prepared using Pulsed Laser Deposition (PLD). Nickel foam has been used as the base material and Nickel layers have been successfully deposited with PLD. The laser-treated electrode exhibits enhanced electrochemical characteristics when compared to the untreated Ni foam.

The above results demonstrate the application of lasers in the preparation of efficient Hydrogen-producing electrodes thus significantly contributing to the green energy transition and global environmental concerns.

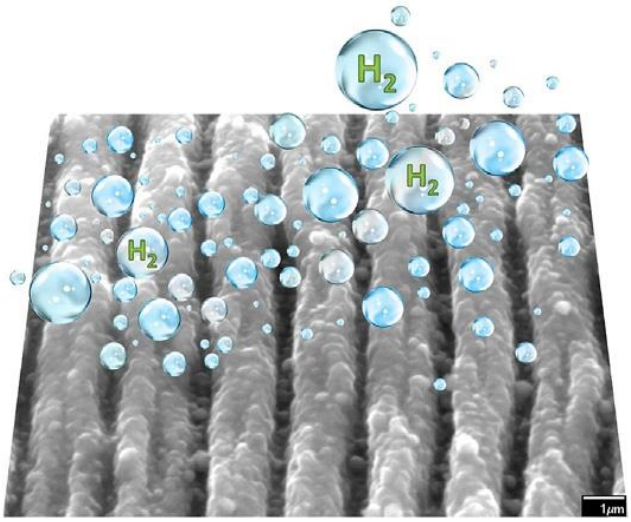

Figure 1: Artists' view of a Hydrogen-producing laser-nanostructured electrode.

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