

Electrocatalytic Green H₂ Generation Using Novel Defect Engineered CoTiO₃-x/TiO₂-x- Perovskite Nanostructures Synthesized by Pulsed Laser Processing

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As the International Energy Agency (IEA) reported in 2021, CO₂ emissions reached 36.3 gigatons. Therefore, there is a pressing need to find an efficient alternative for fossil fuels such as green hydrogen. TiO₂ recently has been explored as a catalyst support, however it exhibits low efficiency. Herein, the goal is to develop novel defect engineered-CoTiO₃/TiO₂ perovskite nanostructures using the Pulsed Laser Ablation in Liquid (PLAL) device. First, D-CoTiO₃ was combined with D-TiO₂, then all 6 samples were placed in an ultrasonication device, then the PLAL device followed by calcination under 700 °C for three hours. Various characterizations were conducted to test the properties of the material, including XRD, SEM, TEM, XPS, LSV, CV, CP, ECSA, EIS and Tafel. The electrocatalytic reaction was conducted afterwards to generate and measure the hydrogen. The material has an overpotential of 0.234 v at a current density of 10 mA/cm², which is 59% more efficient to produce hydrogen than TiO₂. D-CoTiO₃/TiO₂ reached 1294.6 μ mol/g/h and it is highly stable even after 1000 cycles. To conclude, the electrode showed excellent electrochemical performance and exceptional long-term stability compared to recent catalysts such as CoFe₂O₄ - Graphene and NiFe₂O₄-Graphene and others. Efficiency was increased by 59% without any additional cost. This study is highly beneficial as a catalyst for generating green hydrogen. It can also be applied in, water splitting, super-capacitors, and solar cells.

Awards Won:

Second Award of \$2,000

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