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
King Abdulaziz &amp
his Companions Foundation for Giftedness and Creativity: Mawhiba Universal Enrichment Program awards (and a $200 cash prize)