

Photo-thermo-chemical Synthesis of Ultrafine Nano-alloys with Pulse Laser

Pulsed-laser synthesis produces scalable, ultrafine high-entropy nanoalloys at ambient conditions for energy devices.

Nanoalloys, especially high-entropy nanoalloys (HENAs), which contain equal stoichiometric amounts of metallic elements in each nanoparticle, find wide applications. However, the synthesis of HENAs faces challenges due to slow reaction kinetics, which can lead to phase segregation, as well as the need for sophisticated pretreatment of precursors and inert conditions, making scalable fabrication of HENAs difficult. Purdue researchers have developed direct conversion approach where metal salts are converted to ultrafine HENAs on a carbonaceous support using a nanosecond pulsed laser at atmospheric conditions. The reduced metal elements are gathered to form ultrafine HENAs, which are stabilized by the defective carbon support, owing to the unique laser-induced thermionic emission and etching on carbon. This method is scalable, facile, and cost-effective, overcoming the issue of immiscibility.

Technology Validation:

Scalable fabrication of ultrafine high entropy nanoalloys with uniform size down to 1.5 nm by laser induced thermionic emission reduction

Advantages:

- Scalable fabrication of HENAs
- Straightforward and convenient synthesis
- Low-cost method with lower energy consumption

Applications:

- Fuel cells
- Electrochemical energy conversion and storage systems such as batteries, supercapacitors

Technology ID

2022-CHEN-69899

Category

Energy & Power Systems/Energy
Storage
Energy & Power
Systems/Hydrogen & Fuel Cell
Systems
Materials Science &
Nanotechnology/Nanomaterials
& Nanostructures

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- Water splitting and hydrogen production

TRL: 3

Intellectual Property:

Provisional-Patent, 2023-03-30, United States

Utility Patent, 2024-04-01, United States

Keywords: Catalysis, Electrochemistry, Energy, Energy Storage, Fuel Cells, Nanoalloys, Nanotechnology