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Facile Synthesis Of Ni Nanofoam Architectures For Applications In Li-Ion Batteries

Tech ID: 32666 / UC Case 2017-047-0

PATENT STATUS

Country	Туре	Number	Dated	Case
United States Of America	Issued Patent	10,964,942	03/30/2021	2017-047
FULL DESCRIPTION				
Background				
According to the US DOE information,	the 2022 Tesla Model 3 Long R	ange AWD has a range o	of 131 miles of combine	ed city and highway
driving – on a single charge. One of the	e range limiting factors of EVs is	s that the current graphiti	ic anodes have a capac	ity limitation of 372
mAh/gram. Among potential options for	new anode materials, Nickel C	oxide (NiO) is appealing o	due to its theoretical ca	pacity of 718 mAh/g and
lower cost. The challenges with current	NiO based anodes are:			
Low cycling stability.				

- ► Low-rate capability due to its volume expansion.
- Poor electrical conductivity.
- ▶ The variety of nanostructures that have been developed to address these challenges still suffer from drawbacks such as high processing costs and low capacity retention.

Current Invention

Researchers led by the faculty team of Profs. Cengiz and Mihrimah Ozkan have discovered a novel, patented technology. The anode developed is NiO decorated Nickel (Ni) nanowires that are grown directly on Ni nanofoam. In their development, Ni nanowires are synthesized on the nanofoam by heating with Nickel Acetate and Glycerol at 400 deg. C. Additional details can be found in the related materials cited below.



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OTHER INFORMATION

KEYWORDS

Lithium-ion battery, Anode, Lithium

battery anode, Nickel Oxide,

Nanowire Foam, Nickel Nanowire,

- Energy storage, Electric vehicles,
- Consumer electronics, Drone battery

CATEGORIZED AS

Energy

- Storage/Battery
- Materials & Chemicals
 - Nanomaterials
- Nanotechnology
 Materials
- ► Transportation
- Aerospace
 - Automotive

RELATED CASES 2017-047-0, 2016-183-0



Scanning electron microscopy (SEM) images of the NiO nanowire foam (Ni-NWF)



SEM images of the Ni-NWF after 1,000 cycles, the fabricated lab-level prototype

ADVANTAGES

The significant benefits of their discovery are:

- ▶ Demonstrated high stability with a capacity of 680 mAh/g after 1,000 cycles at a rate of 0.5C.
- ▶ Low resistance that translates to superior power performance and lower losses.
- ▶ The materials are synthesized without any carbon, binders, templates or conductive additives.
- Low operating temperature.
- Easily transferred from lab scale to mass production.

SUGGESTED USES

Lithium-ion battery anodes for:

- Electric Vehicles and Plug-in Hybrid Electric Vehicles
- Drones
- Consumer electronics
- Renewable energy storage

STATE OF DEVELOPMENT

Lab level prototype

RELATED TECHNOLOGY

Free-Standing Ni-NiO Nanofiber Cloth Anode for High Capacity and High Rate Li-ion Batteries

RELATED MATERIALS

Template Free and Binderless NiO Nanowire Foam for Li-ion Battery Anodes with Long Cycle Life and Ultrahigh Rate Capability

RELATED TECHNOLOGIES

Free-Standing Ni-Nio Nanofiber Cloth Anode For High Capacity And High Rate Li-Ion Batteries

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