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Upcycling of Packing-peanuts into Carbonaceous Materials for Energy Storage Applications

Inexpensive, scalable solid-state technology upcycles difficult-to-recycle packing peanuts into advanced carbon materials for energy storage, lubrication, and conductivity applications.

Packing peanuts are a great solution for shipping valuable products, but are notoriously difficult to recycle or breakdown for landfill use. They are easily airborne and contain chemical moieties that leach into surrounding media and cause soil and water pollution. Conventionally, carbonaceous nanomaterials are synthesized through very complex and expensive methods with the requirement of plasma and reducing gases, which are difficult to scale up.

Researchers at Purdue University have developed an environmentally friendly, inexpensive, solid-state, and scalable solution for synthesizing 1-, 2-, and 3-dimensional carbonaceous materials and architectures. The process uses polystyrene and starch based packing peanuts as a precursor, which are heat treated. The feedstock is mixed with various s, p, and d block elements and then heat treated to yield a composite hybrid material. Morphology, structure, and particle sizes can be further controlled by activation under CO2 gas. The resulting carbonaceous materials with unique architecture, texture, and high surface area make it a potential candidate for electrochemical energy storage applications including Li-ion and Na-ion batteries and supercapacitors. Upcycled carbon material is a promising material as an additive for lubrication, can act as conducting carbon black for dissipating heat from tire tread, and inks for toners and printers. The proposed method is less expensive than existing solutions and allows for easy modification of the synthesized carbon with various metals, metal oxide, and semiconductor nanoparticles.

To view a video related to this technology, click this link: https://www.youtube.com/watch?v=8UCti2CL2io&feature=youtu.be

Technology ID
2014-POL-66890

Category
Energy & Power Systems/Energy Storage
GreenTech/Circular Economy & Waste Reduction
Materials Science & Nanotechnology/Nanomaterials & Nanostructures

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Advantages:

-Less expensive

-Carbon materials have unique morphology and functional properties

-Easy modification of the synthesized carbon with various metals, metal oxide, and semiconductor nanoparticles

Potential Applications:

-Li-ion and Na-ion batteries

-Supercapacitors

-Additives for lubrication

-Dissipates heat from tire treads

-Inks for toners and printers

TRL: 2

Intellectual Property:

Provisional-Patent, 2014-12-09, United States | Provisional-Patent, 2014-12-10, United States | PCT-Patent, 2015-12-09, WO | NATL-Patent, 2017-05-31, United States | DIV-Patent, 2019-06-24, United States | CON-Patent, 2019-06-24, United States

Keywords: Packing peanut upcycling, carbonaceous nanomaterials, electrochemical energy storage, Li-ion batteries, Na-ion batteries, supercapacitors, conducting carbon black, additive for lubrication, inks for toners, semiconductor nanoparticles