Hyperelastic Binder For Printed, Stretchable Electronics

Tech ID: 27323 / UC Case 2017-060-0

BACKGROUND

Stretchable electronics are a new, emerging class of electronic devices that can conform to complex non-planar and deformable surfaces such as human organs, textiles, and robotics. Functional fillers incorporated with elastic polymers form composites for use in intrinsically stretchable electronics. These composites can be amenable to high-throughput, low-cost, additive printing technologies that include screen, inkjet, flexography, and 3D printing. However, the properties of the functional and elastic materials used to date have been mutually antagonistic, thus limiting achievement of state-of-the-art functional properties and high elasticity. The present invention relates to the development of random composite inks using triblock copolymer for stretchable electronics. The key novelty offered here is the ability to tolerate higher loadings of inelastic, functional materials without sacrificing the elastic properties of the ink.

TECHNOLOGY DESCRIPTION

UC San Diego researchers have developed compositions, fabrication methods and articles of manufacture that pertain to soft triblock copolymers as a hyperelastic binder for the synthesis of elastic, functional inks. Functionalities for inks can range from conductors, insulators, and semiconductors using both inorganic and/or organic functional fillers. The invention thus enables printed stretchable devices of various types, e.g., conductive, photovoltaic, thermoelectric, piezoelectric, light-emitting, electrochemical/physical sensing, supercapacitor, energy storage. Such devices can be printed on textile or skin for applications that require comfort and high performance under deformation.

A specific example was demonstrated for a stretchable, zinc-silver (I) oxide rechargeable battery using polystyrene-polyisoprene-polystyrene as binder for elastic, electroactive inks. This multi-component device involves the synthesis of multiple elastic inks with composite metal/metal oxide powders (carbon black, zinc, silver (I) oxide) for its respective functionality. The stretchable battery can be used to self-power stretchable electronics through various deformations such as 100% stretching, twisting, and indentations.

APPLICATIONS

The invention is suitable for printed stretchable devices/ applications that require comfort and high performance under deformation.

ADVANTAGES

The key improvement offered by this invention is the ability to tolerate higher loadings of inelastic, functional materials without sacrificing the elastic properties of the ink.

STATE OF DEVELOPMENT

A working prototype has been demonstrated that consists of a printed, stretchable, rechargeable AgZn battery with 100% stretchability.

INTELLECTUAL PROPERTY INFO

CONTACT

University of California, San Diego
Office of Innovation and Commercialization
innovation@ucsd.edu
tel: 858.534.5815.

OTHER INFORMATION

KEYWORDS

printed electronics, stretchable electronics, stretchable battery, wearables, triblock copolymers, functional inks, conductive inks, polymers, composites

CATEGORIZED AS

- **Energy**
  - Storage/Battery
- **Materials & Chemicals**
  - Composites
  - Polymers

RELATED CASES

2017-060-0

A provisional patent has been submitted.

RELATED MATERIALS

- Rajan Kumar, Jaewook Shin, Lu Yin, Jung-Min You, Ying Shirley Meng, Joseph Wang. All-Printed, Stretchable Zn-Ag2O Rechargeable Battery via, Hyperelastic Binder for Self-Powering Wearable Electronics. Adv. Energy Mater. 2016 Dec 19 - 12/19/2016

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,143,081	11/27/2018	2017-060
United States Of America	Published Application	20190159337	05/23/2019	2017-060
Patent Cooperation Treaty	Published Application	2018094409	05/24/2018	2017-060

University of California, San Diego
Office of Innovation and Commercialization
9500 Gilman Drive, MC 0910, ,
La Jolla,CA 92093-0910

Tel: 858.534.5815
innovation@ucsd.edu
https://innovation.ucsd.edu
Fax: 858.534.7345