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Redox-Active Polymer Film for LowCost Electronic Tagging

Background

Labels, stickers, RFID tags and other adhesive products are used for communicating information either in writing or electromagnetically. These systems are also often used as the primary or secondary fastening systems in consumer and automotive electronics and various types of enclosures. For example, identification tags may be affixed to a product for the purpose of inventory control. Conventional active and semi-passive tags are prohibitively expensive for low-cost applications and products. Currently, active and semi-passive tags are too expensive for low-cost item inventory control due to the cost of the energy storage component. Conventional active tags typically comprise a battery which powers microchip circuitry. Additionally, active tags may employ batteries to power an antenna for signal broadcast. Semi-passive tags typically comprise a battery to power microchip circuitry, however interrogative electromagnetic waves induce an antenna current for signal broadcast.

Conventional low-cost passive tags do not comprise a battery or energy storage means. Passive tags operate via a backscatter mechanism wherein an incoming interrogative waveform is modulated by the tag and reflected back to a reader. There are several drawbacks of conventional low-cost passive tags including restricted signal ranges, limited "active" time periods and low signal-to-noise ratios due to the absence of an energy storage component.

Thus, there is a need for tag devices and other similar devices made from conductive polymers which can offer existing benefits of tags made from traditional materials, while capable of being integrated with low-cost energy storage devices such as thin film batteries.

Invention Description

Researchers at Arizona State University have developed a tagging device that, in one aspect, includes a substrate upon which a conductive structure is formed, featuring a layer of redox-active polymer film having mobile ions and electrons. The conductive structure includes a first terminal and a second terminal configured to receive an electrical signal therebetween, where the layer of redox-active polymer is configured to conduct an electrical current generated by the mobile ions

and the electrons in response to the electrical signal. The apparatus additionally includes a detection circuit operatively coupled to the conductive structure and configured to detect the electrical current flowing through the conductive structure.

In another aspect, an active tag apparatus comprises an electrochemical energy storage device. The electrochemical storage device comprises two electrode layers, each comprising a redox-active polymer having mobile ions and mobile electrons.

In another aspect, an active tag device comprises a conductive structure having a first terminal and a second terminal and configured to receive an electromagnetic signal therebetween, the conductive structure comprising a redox-active polymer film having mobile ions and mobile electrons and configured to conduct an electrical current generated by the mobile ions and the mobile electrons in response to the electromagnetic signal.

This innovation is covered by U.S. Pat. No. 11,003,870.

Potential Applications

- Low-cost inventory tagging
- Active tagging using thin film batteries
- Radio frequency identification (RFID)