



The world's most powerful flexible battery



**COMPANY OVERVIEW:**

Riot Energy, Inc. is an Agoura Hills, CA based producer of conformal and flexible thin film batteries. Leveraging advanced materials and intellectual property developed with the University of California San Diego, Riot Energy's batteries are safe and environmentally friendly with outstanding performance characteristics. Riot Energy's battery is based on aqueous silver-zinc technology initially developed in larger formats for outer space applications and further developed by the military for underwater applications.

**Riot Energy Capabilities Statement**

**Smart Electrically Powered and Networked Textile Systems (SMART ePANTS) Research Program**

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**BACKGROUND:**

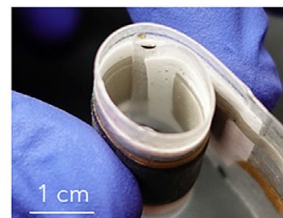
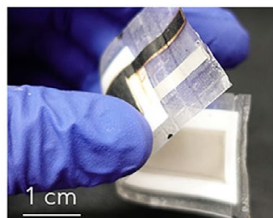
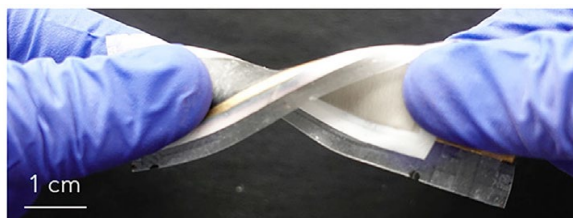
Sponsored work at the University of California San Diego resulted in a new printed battery assembly method of producing batteries that are stretchable with excellent elastic properties. These new flexible batteries are perfect for IoT and wearable applications such as the garment-integrated sensor system for the SMART ePANTS program.

**Riot Advantage:**

Riot's Silver Zinc technology enables batteries that provide 2X to 10X more energy than competitive offerings and are safe, recyclable, and not subject to transportation restrictions. The stretchable form of the battery can be sewn into clothing and labels, can support thin, curved surfaces, and provides superior longevity and power.

**Battery Characteristics:**

Riot Energy's flexible batteries are customizable with respect to size, thickness, and capacity. Alkaline based, they are non-flammable and have an individual open circuit voltage (OCV) of 1.8V. Higher voltages can be achieved with multiple cells. While this would also increase the number of cells needed, they can be placed/encapsulated almost anywhere within the article of clothing due to their flexible design. Cells are washable and therefore will not be required to be removable. Cells can be bent numerous times in multiple dimensions, they can be rolled up or folded, and still perform under stress. They can be as thin as 0.5mm, but can also be made thicker, or stacked depending on the application and physical requirements.



## Riot Energy Capabilities Statement – CONT'D

### Smart Electrically Powered and Networked Textile Systems (SMART ePANTS) Research Program

#### **Battery Characteristics CONT'D:**

The rechargeable silver-zinc technology utilized in Riot Energy's cells has been demonstrated to perform for over a year in use every single day, for a full day while being charged each night in hearing aid applications. The cells can also be stored for up to a year before being put into use. With an energy density of over 350 Wh/L, the resulting cell size required to power most wearable electronics can be quite small. These silver-zinc batteries also have low impedance and high-power capability which is consistent over 95% of the discharge. This pairs well for higher rates associated with Bluetooth communication and also reduce the possibility of brown-out situations near the end of use. Cells can operate between -20C and 60C, with optimal use between room and body temperature, ideal for wearable applications. Additionally, since they do not create heat during operation, they are safe to wear against the skin and do not require any additional insulation.

#### **Development & Testing Capabilities:**

In addition to battery assembly and development capabilities, Riot Energy can also develop and optimize individual cell components and electrode materials in state-of-the-art dry and wet labs. Riot Energy has the applicable equipment and expertise to conduct a variety of material modifications (coating and/or doping) in order to achieve greater cell performance. The facilities contain several pieces of analytical equipment to more fully characterize the energy storage material, such as XRF, BET, and FT-IR. There are also a variety of cell components that Riot Energy has available to tailor cell performance and geometry to a specific use case. Riot Energy has a significant cell testing capability and expertise, with hundreds of Maccor test channels, allowing for a more rapid response for cell optimization. This is due to the ability and flexibility to model a variety of device specific use cases. In addition, there are environmental chambers that offer a variety and mix of temperatures and humidity for testing purposes.

