Docket #: S12-437

Self-Healing Electrode for Lithium Ion Battery

Stanford researchers have demonstrated a self healing electrode that can dramatically enhance the cycle lifetime of lithium ion batteries by applying Si microparticles with a thin layer of self-healing conductive composite. Cracks and damages in the electrode over the large volume changes of Si materials during lithiation and dilithiation were found to be able to self-heal automatically and thus greatly enhance the cycling stability. Batteries with these self-healing anodes have superior capacity and can cycle more than 100 times in half cells while retaining more than 80% of their initial capacity. The cycling lifetime is more than **ten times** longer than state-of-the-art anodes of Si microparticles.

Stage of Development – Prototype
Researchers have attained a cycle life ten times longer than state-of-art anodes made from SiMPs and still retained more than 80% of their initial capacity (up to ~3,000 mA h g?1). The Yi Cui Group continues to refine and improve performance and longevity by testing other self-healing polymers and electrode materials.

Stanford News Article
"Stanford and SLAC scientists invent self-healing battery electrode", November 17, 2013

NPR "All Tech Considered" Feature
"Just Like Human Skin, This Plastic Sheet Can Sense And Heal", April 11, 2016

Applications

- For all types of lithium ion batteries to improve the cycling lifetime including those used in cell phones, electric vehicles, consumer electronics, and electrochemical devices.

Advantages

- Self-healing – this polymer coating can repair cracks within a few hours.
- Cycling lifetime can be increased by more than 10 times
- Cycle more than 100 times in half cells while retaining more than 80% of their initial capacity
- Low cost

Publications

- Wang, C., Wu, H., Chen, Z., McDowell, M. T., Cui, Y., & Bao, Z. (2013). Self-healing chemistry enables the stable operation of silicon microparticle anodes for high-energy lithium-ion batteries. Nature Chemistry, 5(12), 1042-1048.

Patents

- Published Application: 20160049217
- Published Application: WO2014116335
- Issued: 9,490,045 (USA)

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