

## Polymer-Based Battery Technologies

A **polymer-based battery** uses organic materials instead of bulk metals to form a battery.<sup>[1]</sup> Organic polymers can be processed at relatively low temperatures, lowering costs. They also produce less carbon dioxide.<sup>[2]</sup>

### History

Organic batteries are an alternative to the metal reaction battery technologies, and much research is taking place in this area. Waseda University was approached by NEC in 2001, and began to focus on the organic batteries. In 2002, NEC researcher presented a paper on Piperidinoxyl Polymer technology, and by 2005 they presented an organic radical battery (ORB) based on a modified PTMA, poly(2,2,6,6-tetramethylpiperidinyloxy-4-yl meth-acrylate).<sup>[3]</sup>

In 2006, Brown University announced a technology based on polypyrrole.<sup>[1][4]</sup> In 2007, Waseda announced a new ORB technology based on "soluble polymer, polynorborene with pendant nitroxide radical groups."

In 2015 researchers developed an efficient, conductive, electron-transporting polymer. The discovery employed a "conjugated redox polymer" design with a naphthalene-bithiophene polymer that has been used for transistors and solar cells. Doped with lithium ions it offered significant electronic conductivity and remained stable through 3,000 charge/discharge cycles. Polymers that conduct holes have been available for some time. The polymer exhibits the greatest power density for an organic material under practical measurement conditions. A battery could be 80% charged within 6 seconds. Energy density remained lower than inorganic batteries.<sup>[2]</sup>

### References

1. <sup>a b</sup> "Brown engineers build a better battery with plastic". PhysOrg.com. 13 September 2006. Retrieved 3 November 2011.
2. <sup>a b</sup> Kever, Jeannie (2015-04-06). "Researchers discover N-type polymer for fast organic battery". *R&D*.
3. Nishide, Hiroyuki; Takeo Suga (2005). "Organic Radical Battery" (PDF). The Electrochemical Society Interface. Retrieved 3 November 2011.
4. "Brown Engineers Build a Better Battery – With Plastic". Brown University. 13 September 2006. Retrieved 3 November 2011.