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Imergy Uses Recycled Vanadium to Cut Materials Costs for Flow Batteries
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A look at the company's secret slag-to-energy-storage vanadium recipe
Materials costs and capabilities, as well as the tradeoffs involved, must be considered when it comes to every kind of energy storage. Some materials, like lead, zinc or nickel, are cheap and plentiful, but lack the electrochemical punch of metals like lithium or vanadium. But these rarer specialty metals can be harder to obtain, both in their raw state and in the purified forms that go into batteries.

Take vanadium, a metal that's mined in Russia, China and South Africa and is mainly used to produce specialty steel alloys. Vanadium is uniquely useful as an electrolyte for flow batteries, providing some significant power and energy benefits over more common metal combinations (zinc bromine, iron chromium) used by competitors. But it's also far more expensive, with global market prices set by whatever steel industry customers are willing to bear.

Vanadium can also be recycled from mining slag, oil field sludge, fly ash and other waste products. But it's hard to get this recycled stuff up to the 99.5 percent and higher purity standards required for most vanadium flow battery electrolyte formulations.

Unless you're Imergy, that is. The Fremont, Calif.-based flow battery startup announced earlier this month that it's developed a process to use recycled vanadium at slightly lower purity levels -- say, 98.5 percent -- as its electrolyte. That single percentage-point difference in purity comes with a big reduction in costs, Imergy CEO Bill Watkins said in an interview.

Imergy is now actively working with potential suppliers of this recycled material, which will be critical in helping the startup drive costs for its batteries from $500 per kilowatt-hour today -- already an aggressive claim -- to less than $300 per kilowatt-hour in the coming year or so, he said.

"We basically take the contaminants, and we can mask it with our formulation," said Watkins. "We don't have to go to the commodity vanadium markets around steel -- we can create our own markets."

Imergy, formerly known as Deeya Energy, changed its name last year and announced a switch from its former iron-chrome flow battery chemistry to a new chemistry developed by Chief Technology Officer Majid Keshavarz. This new chemistry involves a lot of top-secret intellectual property, and Watkins said that the startup has filed multiple patents, some of them having nothing to do with what the company is pursuing at commercial scale right now, to keep its secret sauce hidden.

Some core changes involve a switch from the sulfuric acid normally used to another acid, which reduces the problem of hydrogen forming in the charged electrolyte, he said. Beyond that, the startup uses additives that help reduce operating temperatures, as well as masking the effects of contaminants.

In other words, Imergy hasn't broken new ground in how vanadium is recycled per se. Rather, it happens to have a chemistry that can use lower-grade vanadium and is making use of that. In terms of the range of recycled source materials, "we've tested about four different sources, each with different origins, whether it's iron-based, or more of a carbon link, or even ammonia-based," Tim Hennessy, company president, said. "They're all working for us."

“The key on this is that the spread right now between conventional market vanadium, and what you can get from waste sources, is more than three times,” added Hennessy. “The true cost of getting it out of the ground is much lower, and [vanadium producers are] making a mint on it.”

Imergy is working with contract manufacturer Flextronics to make a 5-kilowatt, 30-kilowatt-hour battery for cellular towers and other remote applications, and has larger formats in design and testing, including a 30-kilowatt, 120-kilowatt-hour, container-sized system for microgrid or building backup power, Watkins said.

Imergy isn’t the only flow battery company looking for innovative ways to reduce materials cost. One interesting example is the relationship between Gildemeister/DMG Mori Seiki, the German-Japanese company that makes the CellCube vanadium redox flow battery, and partner American Vanadium, which is seeking to develop a low-cost source of vanadium in Nevada.

Imergy is just one of several flow battery startups promising big breakthroughs in multi-hour energy storage, and others have larger projects underway, including Primus Power, EnerVault and CellCube. For Imergy, much would appear to ride on how well its recycled vanadium-based batteries do in pilot and commercial deployments. But the startup certainly has aggressive goals for growth.

“We need to line up a consistent source we understand, and a refinery partner to refine that source consistently. We have everyone from Russians to Australians to Chinese talking to us,” Watkins said. But “within a year, we’ll be 100 percent” switched over to the new recycled vanadium format, he said. “We want to build this fast, and we can.”