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The Key to the Battery-Powered House: Q&A With Ceramatec

Homegrown renewable energy has a problem; sources such as wind and solar are inconsistent since the sun doesn't shine all the time, and the wind doesn't always blow. To tackle this, researchers have been looking for a small, safe and compact in-home battery capable of storing excess power for use during the renewable doldrums. Ceramatec, a Salt Lake City-based branch of CoorsTek, might finally have the solution. PM caught up with Ceramatec president and CEO Ashok Joshi at the 2009 Breakthrough Awards to see how he thinks this technology will live up to the hype.

BY JOE P. HASLER

Ceramatec's advanced-materials specialists and electrochemists have developed a sodium-sulfur battery that potentially could produce 5 kilowatt-hours for 4 hours before needing to recharge. So far, Ceramatec's scientists only have a prototype--a super-thin ceramic conductor sandwiched between a sodium-metal anode and a sulfur-compound cathode--that proves the concept of a high-energy-density battery that operates at relatively low temperatures. But expectations for Ceramatec's battery are high. In April, the (Provo) *Daily Herald* profiled the company and its sodium-sulfur deep-storage battery, and called the technology "the single most important breakthrough for clean, alternative energy since Socrates first noted solar heating 2400 years ago." Here is Ceramatec CEO Ashok Joshi with the latest on the company's research.

PM: Tell us about the battery. What makes this technology so special?

Ashok Joshi: It's basically an off-grid energy-storage system. I call the battery "personalized energy." The whole idea of creating this battery is that you can have it interface with wind or solar power to store that energy. This addresses the issue of the wind not blowing, or the sun not shining all the time. That's the intent of the battery.

PM: Why have you decided sodium-sulfur is the way to go?

AJ: If you're going to develop a battery, cost is a major factor. Compare sodium versus lithium--sodium is everywhere, and it's plentiful. It's one of the most abundant elements on earth, so it's far less expensive than lithium.

Actually, Ceramatec's founding technology, in 1976, was a battery that used sodium-sulfur technology. Back then, in the early years, we were a small company and we struggled to get financial support. So we gave up in 1986. But we never gave up on the idea. We gave up on the effort to build the battery. We didn't give up on the idea that one day this battery could be the future of America.

PM: So by becoming a part of CoorsTek, Ceramatec now has that support?

AJ: Previously, I individually owned the company. And it was only a research and development company. I had no way to do full-scale commercialization. Joining with Coors opens up the possibility of commercializing technology. Because of CoorsTek, we'll get the funding we need.

It's a tall order to develop a battery. It requires huge amounts of capital resources to make it happen. For example, A123 raised almost half a billion dollars before they could make their

batteries. So we're looking for large amounts of money. It depends on how much we can get, and how quickly we can get it, because we have a critical mass--critical employees--that we need to support and employ so we can develop the technology.

PM: What remains to be done in the development?

AJ: The eureka moment has passed. We know that this will work. The science is there. We just need to optimize it now. It just depends on finding the right anolyte--meaning the electrolyte of sodium plus something else. We have the ceramic membrane between, then the catholyte side--sulfur plus something else. We're in the lab trying combinations, and trying to find what is the best anolyte, and what is the best catholyte, and trying improve the electrolyte conductivity. Now if we make this ceramic membrane thin enough, which CoorsTek has a tremendous capability of doing, then we've got everything necessary to operate at ambient temperatures.

PM: How low can you go?

AJ: The only sodium batteries that exist now operate at high temperatures. We want to reduce the temperature of the battery so that it can operate around 100 degrees Celsius, rather than 400 degrees Celsius, which is now the standard. Because below 150 degrees Celsius, that becomes a manageable temperature if you want to put it in the home.

Today, in our laboratory, we've demonstrated the ambient temperature battery. But this has lower power because the electrolyte ceramic is thick right now. But if we make the thickness 100 times lower, then we've got it. We've proven we can cycle it, but there are challenges of making the electrolyte thin, and adjusting the anolyte, but we are working on it. We have a combination that is proof of the principle, which works brilliantly. But it works at a very low current. Now, we need to increase that current tremendously, so we need to work on a thinner electrolyte membrane, and optimize the anolyte and catholyte. Right now we are in the 1 milliamp range. We need to get that up to 100 millamp. If we want to do that and keep it at an ambient temperature, we need to reduce the thickness of the membrane. The other way, of course, is to increase the temperature.