PATRICK SOON-SHIONG INNOVATION AWARDS 2013

WINNER

SAFCELL INC.

Pasadena

SAFCell, Inc. develops scalable solid acid fuel cell (SAFC) stacks for applications requiring tens of watts to tens of kilowatts. Operating at mid-range temperatures around 250°C, SAFCell's stacks tolerate fuel impurities that pose obstacles to other fuel cell technologies. This allows SAFCell stacks to run more easily on commercially available gas fuels (e.g., propane and butane) or liquid fuels (e.g., methanol, diesel and bio-oils), greatly reducing the overall fuel cell system complexity and cost. SAFCell is partnering with targeted system integrators to enter first portable, and then stationary power markets.

SAFCell's core technology is the use of a solid acid electrolyte (CsH2PO4), a solid-state proton conducting material intermediate between normal salts and normal acids, pioneered at the California Institute of Technology (Caltech). High fuel impurity tolerances allow SAFCs to run on commercially available fuels, such as propane and diesel, with minimal system complexity. As such, SAFCs offer significant durability and cost advantages over these lower-temperature fuel cell technologies when operating on commercially available fuels.

In combination to the use of commercial fuels, SAFC's stacks are made of inexpensive metal and polymer components that both reduce overall stack costs and result in a very rugged stack design. Other fuel cell technologies that tolerate such fuel impurities operate much higher temperatures, driving up the cost and reducing durability. As such, only SAFCs offer the combination of commercial fuel use, high durability, and low stack costs when compared to both lower and higher temperature fuel cell technologies. Compared to standard generators, SAFCs deliver longer lifetimes with less maintenance.

SAFCell, Inc. was founded in November of 2009 by Dr. Calum R.I. Chisholm and five other dedicated co-founders, to develop and commercialize SAFCs. However, the story of this technology goes back ten years earlier to the Materials Science Department at Caltech, where as a graduate student Dr. Chisholm and fellow graduate student, Dr. Dane Boysen, made the first solid acid fuel cell, generating a whopping 15 micro-Watts of power. Since then, the technology has been scaled to the over 1.5 kW, a million fold increase in power output.

Drs. Chisholm and Boysen investigated the fundamental properties of a class of materials known as super-protonic solid acids, named such for their ability to transform into highly conductive solid-state proton conductors under specific temperature/pressure conditions. During their scientific investigations, and in collaboration with other scientists, it became clear that the materials could operate stably under fuel cell conditions.

Since then, the SAFCell team has automated cell fabrication and streamlined stack fabrication, resulting in a very stable stack platform producing tens to thousands of kilowatts. These robust and rugged pre-commercial stacks have helped to convince multiple system integrators to build full SAFC systems running off of methanol, propane, natural gas, and diesel fuels. Ongoing efforts will produce the first commercial SAFC power units in 2014 for portable and mobile power applications. Future development efforts at the cell and stack level will increase stack lifetimes and decrease stack costs, allowing SAFC power units to enter into small stationary markets, like remote, back-up, and residential power.

Calum Chisholm of SAFCell Inc.