Researchers develop miniaturized fuel cell that makes drones fly more than one hour

March 8 2016

Drones are used for various applications such as aero picturing, disaster recovery, and delivering. Despite attracting attention as a new growth area, the biggest problem of drones is its small battery capacity and limited flight time of less than an hour. A fuel cell developed by Prof. Gyeong Man Choi (Dept. of Materials Science and Engineering) and his research team at POSTECH can solve this problem.

Prof. Choi and his Ph.D. student Kun Joong Kim have developed a miniaturized solid oxide fuel cell (SOFC) to replace lithium-ion batteries in smartphones, laptops, drones, and other small electronic devices. Their results were published in the March edition of *Scientific Reports*.

Their achievement has been highly evaluated because it can be utilized, not only for a small fuel cell, but also for a large-capacity fuel cell that can be used for a vehicle.

The SOFC, referred to as a third-generation fuel cell, has been intensively studied since it has a simple structure and no problems with corrosion or loss of the electrolyte. This fuel cell converts hydrogen into electricity by oxygen-ion migration to fuel electrode through an oxide electrolyte. Typically, silicon has been used after lithography and etching as a supporting component of small oxide fuel cells. This design, however, has shown rapid degradation or poor durability due to thermal-expansion mismatch with the electrolyte, and thus, it cannot be used in actual devices that require fast On/Off.

The research team developed, for the first time in the world, a new technology that combines porous stainless steel, which is thermally and mechanically strong and highly stable to oxidation/reduction reactions, with thin-film electrolyte and electrodes of minimal heat capacity. Performance and durability were increased simultaneously. In addition, the fuel cells are made by a combination of tape casting-lamination-cofiring (TLC) techniques that are commercially viable for large scale SOFC.

The fuel cells exhibited a high power density of ~ 560 mW cm-2 at 550 oC. The research team expects this fuel cell may be suitable for portable electronic devices such as smartphones, laptops, and drones that require high power-density and quick on/off. They also expect to develop large and inexpensive fuel cells for a power source of next-generation automotive.

With this fuel cell, drones can fly more than one hour, and the team expects to have smartphones that charge only once a week.

More information: Kun Joong Kim et al. Micro solid oxide fuel cell fabricated on porous stainless steel: a new strategy for enhanced thermal cycling ability, *Scientific Reports* (2016). DOI: 10.1038/srep22443

Provided by Pohang University of Science & Technology (POSTECH)