PORTABLE SOFC GENERATOR WITH INNOVATIVE SPIROCELLs

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The innovative, patented solid oxide fuel cell design (trademark SPIROCELL®) presented at the 5th European SOFC Forum in Lucerne [1] will soon be integrated into a portable SOFC system of equally innovative appearance. SPIROCELL stacks of high volumetric (close to 1 kW/Liter) and gravimetric (close to 1 kW/kg) power density will be used to energize the portable generator designed to deliver up to 1 kW (depending on operating temperature) at 24 VDC. Because of the extreme simplicity of cell, stack and system design and relatively low temperature operation, the portable system will be a bucket-size container weighing less than 10 kg. It will be capable of running on Methanol and Ethanol, perhaps also on Propane or Butane. Because of the simplicity of the cell and stack design the cost of fabrication will be sufficiently low to make the portable SOFC unit competitive with conventional portable generators. Initial system experiments are scheduled for the early part of 2003 and first results will be presented at the conference in April 2003.

The SOFC stack is cylindrical appearance. Each circular cell is a self-contained unit that can be tested prior to stack assembly. Structural support is provided by a sheet metal separator / interconnect disk with innovative flow field design for air and fuel. The active component is either a porous metal substrate with physically deposited active layers, or a ceramic membrane of the anode or electrolyte supported variety. A circular cover plate closes the center of the porous body. Both cell components are mechanically joined by tube rivets during the cell assembly process. Fuel is admitted to each cell from a center hole into the space between base plate and cover. Air is also delivered from the center region, but through six passages penetrating each cell. Fuel and air spaces are separated from each other suitable means. The design lends itself to low-cost mass fabrication. The principal cell design and initial results of the verification experiments will be presented.

The targeted cell life is 1,000 to 2,000 hours. Initially, SPIROCELLs are not designed for longevity, but for easy stack replacement. No more than 5 minutes are needed to replace a defective stack in a cold system. There are many applications for such DC power sources, in particular, as the basic design can be adapted to run on biogas, natural gas or even vaporized liquid hydrocarbons. To make such a small power generator truly "portable", its weight should not exceed the weight of a bucket of water or 10 kg.

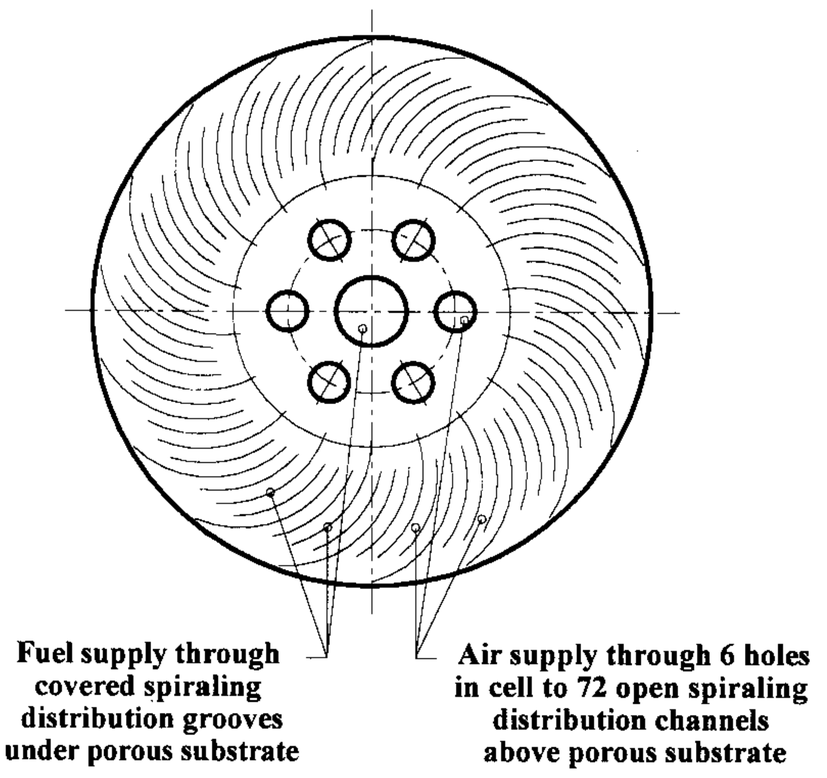

Figure 1 Footprint of the patented SPIROCELL design

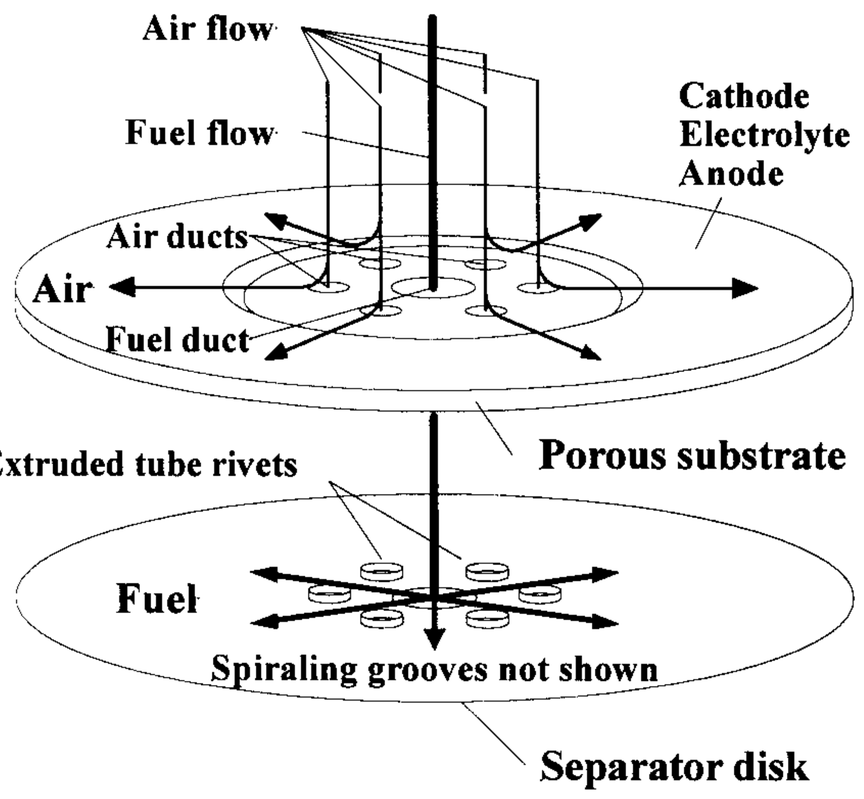

Figure 2 Schematic illustration of the fuel and air flow within a SPIROCELL

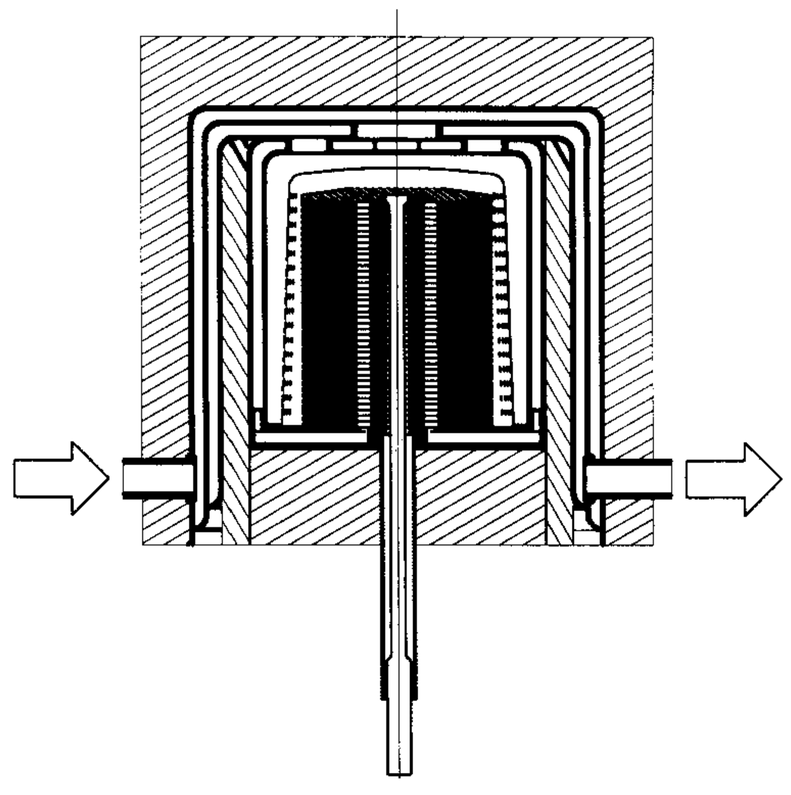

Figure 3 Schematic drawing of the portable 1 kW DC SOFC power generator