Direct Methanol Fuel Cell Technology and Products for Portable Power Applications

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This paper will describe recent advances in the development of direct methanol fuel cell products for consumer electronics applications. Interest in this area of fuel cell technology is not confined to this domain of applications alone, as this market domain has good potential to provide the first opportunity of market entry for fuel cell technology in general.

The paper will first provide a comparative evaluation of several fuel cell technology options available, at least in principle, for this domain of applications. These break down according to the fuel employed and according to whether the system is a direct, or indirect fuel cell. Pro's and con's for each option will be highlighted, explaining why the DMFC option looks most promising based on the need to maximize the number of watt-hours to the load per cc of fuel contained in the cartridge, as well as the simplicity of a direct fuel cell system that enables better packaging, i.e., more effective miniaturization for hand held device applications.

Having highlighted "system simplicity", as an important attribute, the direct methanol fuel cell power system has been considered by some anything but simple, because of the combined, frequently highlighted issues of "methanol cross-over" and of "complex water management". Indeed a key to implementation of DMFC system of real high simplicity at MTI Micro, has been a DMFC technology platform that can be described as quite revolutionary. It is based on fuel delivery control that enables to cut fuel loss by crossover in DMFCs with Nafion^{R} membranes down to 10% (90% fuel utilization) and, at the same time, enables to deliver 100% methanol into the cell anode without any need to pre-dilute the methanol and without the need to collect water from the cathode and pump it back to the anode. Instead, all the water required for the anode process is returned from the cathode to the anode across the thickness dimension of the cell.

Having reduced to practice and demonstrated, in a large number of prototypes, this novel DMFC technology platform of "100% methanol delivery into a DMFC with no need of external water management", we are now at a point where this technology platform is translated into first product(s) to market and where miniaturization has been advanced to the level of a hybrid, DMFC/battery system of total volume of 40cc (max.) , that is projected to enable use time per single cartridge full of methanol significantly exceeding use time per recharge allowed for the same cell phone when powered by battery alone.