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Publication date:
2011

Document Version
Publisher's PDF, also known as Version of record

Risø International Energy Conference 2011
Energy systems and technologies for the coming century
10th-12th May 2011

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Solid oxide fuel cells (SOFCs) are promising candidates in a greener and more dynamic energy system, where efficiency and flexibility are key parameters. The SOFC technology offers high efficiency in the conversion of chemical energy to electrical energy, and high flexibility in regards to operating fuel (from hydrogen to various complex hydrocarbons), and with potential system sizes ranging from 1-5 kW (for mobile and distributed energy systems), to 30 MW central units.
Ceramic high-temperature SOFCs have been developed for the past decades to a high technical level, and are currently being taken to a precommercial production level. Despite of this, commercial success for many applications is challenged by high cost of the cell materials, the inherent low robustness of ceramics, and degradation at the high temperatures.
A new generation of SOFCs based on metal has received increased interest. In the metal-supported SOFC, the main ceramic component is substituted with stainless steel, and the design promises lower material costs, higher robustness of the cell, both in a production line as well as under operation, with lower overall system costs as result. However, substituting one component for metal is not straightforward. Metal requires lower operating temperatures, and to retain the energy output at the lower temperatures, all cell components must be re-evaluated with respect to design and material choices. In addition, the fabrication steps must be reassessed as classical ceramics processing is not in all cases suitable for metallic materials.
A unique metal supported cell design has recently been developed at Risø DTU in collaboration with industry partners, in national and EU projects. The design has been demonstrated to perform better, or in the same range, as the conventional ceramic SOFCs. Focus is now on improving the fabrication steps in combination with enhancing durability to make it suitable for all SOFC applications.