1. Publishable summary

Summary description of project context and objectives

The aim of the project is to develop uniform and industry wide test modules and programs for solid oxide cell and stack (SOC) assembly units. New application fields which are based on the operation of the SOC cell/stack assembly in the fuel cell (SOFC), in the electrolysis (SOEC) and in the combined SOFC/SOEC mode are addressed. This covers the wide field of power generation systems, e.g. stationary SOFC µ-CHP, mobile SOFC APU and SOFC/SOEC power-to-gas systems.

The proposal builds on the experience and the methodology gained in previous European projects, e.g. "FCTESTNET" and "FCTESQA". However, these projects focused mainly on single cell tests and system level tests under steady state conditions. On the other hand other relevant stack projects, e.g. the "STACKTEST" project, do not address the high temperature fuel cell technology. None of these projects focus on the development of test procedures of solid oxide cell/stack systems under dynamic operation conditions or in the electrolysis mode. Moreover, established advanced characterization techniques, e.g. the electrochemical impedance spectroscopy (EIS), have not yet been integrated in the test protocols of these previous projects. Only few results were validated by round robin tests.

It is intended to develop a full set of application specific testing modules and programs addressing function, performance, durability and degradation. Within the project, the test modules and test programs will be established and experimentally validated. The test procedures will be developed on stack relevant test specimens, e.g. on short stacks with 5 cells. The test modules and programs will consider all relevant operating conditions of the complete SOC test system, e.g. input gases, pressure levels, temperatures, current loads, voltage level, mechanical loads, dynamic transients etc. In order to systematically study these effects, a sound understanding of the interaction of the test object with the test station shall be developed.

For the SOCTESQA project an organization and management structure has been built that suits the multitude of activities. In this project six European partners and one non-European partner are involved. These are DLR (coordinator, Germany), CEA (France), DTU (Denmark), ENEA (Italy), JRC (Belgium), EIFER (Germany) and NTU (Singapore). During the project there will be a close interaction with an industrial advisory board (IAB) in order to achieve an industrial relevant outcome of the project. Additionally, a continuous liaison with standards developing organizations (SDOs) is aspired with the aim to implement the outcome of the project successfully into international standards. The activities are organized in work packages (WP), which are coordinated by work package leaders. These are WP 1: Coordination (DLR), WP 2: Specifications and Procurement (JRC), WP 3: Testing Procedures (EIFER), WP 4: Solid Oxide Fuel Cell (DLR), WP 5: Solid Oxide Electrolysis Cell (CEA), WP 6: Combined SOFC/SOEC (DTU), WP 7: Dissemination and Liaison (ENEA). Each work package contains several tasks, which are coordinated by task leaders. In this project the work package leaders are also the leaders of the corresponding tasks in their WP.

For the achievement of the project objectives, two workflow paths have to be taken into account. The first path is the development of the test modules and programs. This path will have a clear structure based on an initial definition phase, the development of generic test modules which will be validated by experimental validation phases. The review of the test procedures will result in modified test procedures leading to a subsequent second validation loop. At the end of the project, the final test modules will be confirmed by round robin tests. As mentioned above, the second path of the project refers to the liaison activities to the industrial advisory board industry (IAB) and to standards developing organizations (SDO).