Roberto Spotorno

Fixed-term assistant professor

roberto.spotorno@unige.it
+39 0103536167
+39 0103536145

Education and training

2015
PhD in Chemical Sciences and Technologies
Development of Stack Components for New Generation Solid Oxide Fuel Cells
University of Genoa - Genoa - IT

2011
Master degree in Materials Science and Engineering
Development of Cathodes for Solid Oxide Fuel Cells by Suspension Spraying and Sintering - 110/110 cum laude
University of Genoa - Genoa - IT

Academic experience

2018 - ONGOING
Researcher
University of Genoa - Genoa - IT
Teaching metallurgy classes / Project management / Research on fields of metallurgy - electrochemistry and materials science

2016 - 2018
Post-doctoral fellow
University of Genoa - Genoa - IT
Teaching activity in metallurgy classes / Project management / Research in the field of corrosion and characterization of SOFC materials

2015 - 2016
Post-doctoral fellow
National Council of Research - Genoa - IT
Project management / Research in the field of SOFC materials development and characterization

Language skills

Italian
Mother tongue

English
Proficient

German
Independent

Research interests

My research interests are related to the study of SOFC materials, understanding corrosion mechanisms in solution and at high temperatures. Hereafter each activity is described in detail:

- **Development of contacting materials for solid oxide fuel cells (SOFC):** this activity consists in the development of conductive materials ensuring stable electrical contact between SOFC electrodes and metal interconnects. Such materials are currently synthesized by sol-gel methods and characterized by means of electrochemical impedance spectroscopy and polarization curves on working SOFCs.
- **Study of glass-steel interaction in SOFC stacks:** the aim of this research is the identification of the interactions between ferritic stainless steel interconnects and commercial glass-ceramic sealants at SOFC operating conditions.
- **Study of microstructural evolutions of anodes in SOFC stacks under degradation:** this study consists in the characterization of degradation processes occuring in SOFC anodes and the microstructural optimization by means of inkjet printing and electrostatic deposition techniques.
- **Study of corrosion mechanisms:** in this activity are carried out corrosion tests on non-ferrous alloys in acqueous solutions with and without the presence of bacteria to investigate the corrosion mechanisms promoted or inhibited by the presence of biofilm. The electrochemical techniques used in this research includes potentiodynamic measures, electrochemical impedance spectroscopy, electrochemical noise and monitoring of open circuit potential.

- **Development of protective coatings for high temperature applications:** Protective coating are applied using several deposition techniques (galvanic, electrophoretic and dip-coating). This study consists in the coating optimization by tuning the compositions and process parameters in order to obtain the best performing coatings in term of electrical properties, compatibility with the substrate and protection against element diffusion and oxidation.

- **Development of mathematical methods for the interpretation of electrochemical measurments: :** The application of electrochemical techniques to investigate novel systems and processes is difficult due to the lack of data and knowledge in literature. For this reason, mathematical methods are applied to deconvolute the electrochemical contributions of the processes under investigation. Additionally, noise detection and correction methods are applied to study non-linear systems, characterized by strong time-dependecy.

Grants

2018 - ONGOING

HArnessing Degradation mechanisms to prescribe Accelerated Stress Tests for the Realization of SOC lifetime prediction Algorithms (AD ASTRA)

European Union - H2020 - FCHJU2

340000 - Participant

AD ASTRA aims to define Accelerated Stress Testing (AST) protocols deduced from a systematic understanding of degradation mechanisms of aged components in solid oxide cell (SOC) stacks, operating in both fuel cell and electrolysis modes. In particular, fuel and oxygen electrode issues and interconnect contact loss will be tackled.
The approach to harnessing the intricate phenomena causing critical performance degradation will be based upon a methodical analysis of in-service performance data correlated with post- operation states, augmented by a dual-focus campaign targeting macroscopic stack testing procedures as well as specific component ageing tests. The probabilistic nature of degradation will be captured by slimming down deterministic simulation models through conception and integration of stochastic correlations between (nominal/accelerated) operating conditions and degradation effects, based on statistically significant data obtained from field-tests and purposely generated experiments. Stochastic interpretation will thus serve the
physical description of dominant SOFC degradation mechanisms in CHP and P2X operation, but allowing rapid estimation of remaining useful stack life. The combined results will be translated to validated test protocols that allow quantifying and predicting degradation in SOCs as a function of test aggravation, defining appropriate transfer functions between stress-accelerating and real-world conditions. The overall project approach will be formalized for adoption by the relevant standards-developing organisations.

2014 - 2017

ENhanced DURability materials for Advanced stacks of New solid oxide fuel CElls (ENDURANCE)

European Union - FP7 - FCHJU

2'400'000 - Participant

A 12 partners 6 countries project focused on the understanding of the sources and mechanisms of degradation and failure in stacks of solid oxide fuel cells operated in real conditions. This in order to enhance and extend the reliability by applying adequate investigation protocols and efficient solutions to mitigate risks and troubles.