Paolo Piccardo

Associate professor

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Education and training

1997

Ph.D. Chemical sciences

Metallurgical processes and metal-environment interaction in ancient and modern metal alloys

Università di Genova - Genova - IT

1993

Master in Chemistry

Structural investigation on Ligurian bronze findings from X-VI centuries BC - 110/110 e lode

Università di Genova - Genova - IT

Academic experience

2012 - ONGOING

Associate Professor in Metallurgy

Università di Genova - Genova - IT

Metallurgy research group coordinator (Lab of Metallurgy and Materials). In charge for metallurgy classes

1999 - 2012

Assistant Professor in Metallurgy

Università di Genova - Genova - IT

Management of metallurgical researches teaching metallurgy

Work experience

2012 - ONGOING

Metallurgy teacher

Université de Bordeaux Montaigne - Bordeaux - FR

management of classes on Metallurgy applied to cultural heritage

Language skills

English
Proficient

French
Proficient

Spanish
Independent

Italian
Mother tongue

Teaching activity

The teaching activity is mainly composed by two major courses:
Metallurgy 1 (Bachelor in Chemistry and Chemical Technologies, Bachelor in Materials Sciences, Master in Methodologies for the conservation and restoration of cultural heritage, Master in Chemical Engineering)
The goal of the course is to give solid bases on metals, their properties, their behaviours and the relationships with their chemical nature (e.g. metal bond, lattice, alloying, volume and punctual defects). The properties taken into account are related to chemistry (e.g. corrosion and diffusion processes) and to mechanical resistance (e.g. stress-strain, creep, fatigue, hardness, resilience). The correlation within thermomechanical treatments, microstructural features, properties and chemical composition are explained with various examples mostly related to Fe-C alloys.
Metallurgy 2 (Master in Science and Engineering of Materials, Master in Chemical Sciences, Master in Industrial Chemistry, Master in Chemical Engineering)
This course is the natural follow up of Metallurgy 1. It is meant to enhance the knowledge acquired in the previous classes by adding a systematic vision of the effect of each alloying elements in iron based alloys with practical examples on common and special steels with related applications. The main commercial and advanced steels are explored and discussed as well as classical, modern and innovative manufacturing methods (i.e. from casting to 3D printing). The course is completed by laboratory sessions and technical visits to industries.

Research interests

Metallurgy, Metallography and materials properties. Metal-environment and metal-inorganic materials (e.g. ceramics, glasses) interactions. Impact of thermo-mechanical deformation on the intrinsic properties of metals. Corrosion in wet and dry (high temperature) conditions. Long lasting corrosion and release in the surrounding environment. Relationships among chemical composition, thermo-mechanical history, microstructural features, and physical-chemical properties of metals. Materials for energy conversion and production with special attention to Li-Ion batteries and fuel cells (e.g. solid oxide fuel cells). History of metallurgy and metalworking. Conservation and restoration of cultural heritage. Science and knowledge dissemination by organizing or participating to public events, happenings, meetings, lectures, demonstrations, festivals.

Grants

2008 - 2011

An Innovative Dual-mEmbrAne Fuel Cells (IDEAL-Cell)

European Union FP7 - BE

300000 euro - Participant

The main goal of the project was to develop a new architecture (called dual or central membrane) of the electrolyte of Solid Oxide Fuel Cells by combining protonic and anionic electrolyte materials. My role has been to

design the stack and to investigate the metal-electrodes interactions as Interconnect manager.

2014 - 2017

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

European Union FP7 - FCHJU - BE

2400000 euro - Pricipal investigator

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

2018 - ONGOING

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

European Union H2020 FCHJU2 - BE

340000 - Pricipal investigator

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 project will build upon relevant information harvested in FCH JU projects, as well as make use of many samples taken
from stacks operated in the field for thousands of hours, supplied by leading European SOC manufacturers across the two
application areas CHP and P2X (combined heat&power generators and power-to-commodity energy storage).
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.

Editorial activity

Project referee for the French-Italian University
Project referee on Fuel cells for the French Minister of researches.

Other professional activities

I am active as a contultant and expert through the Laboratory of Metallurgy and Materials that I coordinate. The main fields are:
- metallurgy
- Li-Ions batteries
- Fuel Cells
- archaeometry applied to archaeology and cultural heritage