PERSONAL INFORMATION

Michele Mascia

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POSITION Associate professor

EDUCATION AND WORK EXPERIENCE

Graduated in Chemical Engineering, PhD in Industrial Engineering, Associate Professor of Chemical Plant design at the Department of Mechanical Chemical and Materials Engineering (formerly Department of Chemical Engineering and Materials) of the University of Cagliari. Teacher of Unit Operations and Chemical Plant Simulation for the degree course in Chemical Engineering; teacher of Chemical Plant Design for the postgraduate course in Chemical Engineering.

His research activities are focused in the field of electrochemical engineering applied to the study of processes for environmental remediation and energy conversion. In particular, the study covers key aspects such as the catalytic activity of electrode materials and the identification of reaction mechanisms, as well as practical aspects of design and characterization of reactors.

With regard to the environmental remediation, processes have been studied for removal of toxic organic pollutants from industrial waste water and from natural waters. Through experiments and mathematical models, electrochemical reactors were studied on a laboratory scale in order to address the research towards an applicative approach. In this context, the design, characterization and mathematical modeling of electrochemical reactors made it possible to successfully carry out the treatment, even in the case of trace contaminants.

The application of the results was recently extended to the disinfection of natural waters. The products of the oxidation of chloride ions in aqueous solutions were identified, and the effect of current density, residence time and mass transfer rate on distribution and concentration of electrolysis by-products was studied. Particular attention was paid to the hydrodynamic of the reactor.

Research on energy conversion has focused mainly on the study of effective electrocatalysts for water electrolysis applied to hydrogen production, for the use of hydrogen for energy production in fuel cells.

Attention was then paid to the photo-electro-splitting of water: the activity involves the electrochemical synthesis of nanostructured Titanium oxide electrodes: non-doped TiO2 nanotubes were prepared by anodic oxidation of Ti foils, followed by thermal annealing. Anodisation was carried out in aqueous electrolytes containing fluorides, as well as in organic electrolyte, glycerol and ethylene glycol. The formation and the geometry of the nanotubular arrays were investigated under different operative conditions. The coating of conductive surfaces with refractory metals has been recently studied. In particular, electrodeposition of Nb, Ta, Zr and bimetallic Nb/Cu and Ta/Cu composites has been achieved from low temperature ionic liquids. According to the electrochemistry of the metals considered and based on the experimental results, the possible reaction path for the oxidation/reduction was proposed. Structural and chemical analyses indicate that the obtained deposits cover uniformly the electrode surface and exhibit individual layers with a characteristic size ranging between 50 and 100 nm.

Michele Mascia has also skills in electrochemical characterization of surfaces through electrochemical techniques, such as cyclic voltammetry and electrochemical impedance spectroscopy. The results of all the researches have been published in international scientific journals and presented at major international conferences.