PERSONAL INFORMATION

Paola Rizzi

Via Giuria 7, 10125 Torino, Italy

+390116707565

paola.rizzi@unito.it

Sex Female *Date of birth* 29/11/1968 | *Nationality* Italian

WORK EXPERIENCE

From 1/12/22 – to now

Full professor, Department of Chemistry, University of Torino
Teaching and research activities in materials science

From 2014 – to 31/11/22

Associated professor, Department of Chemistry, University of Torino
Teaching and research activities in materials science

From 2004 to 2024

Researcher, Department of Chemistry, University of Torino
Teaching and research activities in materials science

EDUCATION AND TRAINING

1994-1997

PhD in Chemistry

Replace with EQF (or other) level if relevant

Department of Chemistry, University of Torino

Synthesis and characterisation of nanocrystalline metallic materials obtained from devitrification of amorphous precursors

PERSONAL SKILLS

Mother tongue(s) Italian

Other language(s) English
French

Recent publications

Recent publications related to the call

1) N.Belmonte, V.Girgenti, P.Florian, C.Peano, C.Luetto, P.Rizzi, M.Baricco, “A comparison of energy storage from renewable sources through batteries and fuel cells: a case study in Turin, Italy” International Journal of Hydrogen Energy, 41 (2016) 21427 - 21438 http://dx.doi.org/10.1016/j.ijhydene.2016.07.260
2) Nadia Belmonte, Carlo Luetto, Stefano Staulo, Paola Rizzi, Marcello Baricco, “Case studies of energy storage with fuel cells and batteries for

stationary and mobile applications", Challenges, 8 (2017) 9; doi:10.3390/challe8010009
3) Alessandro Agostini, Nadia Belmonte, Alessio Masala, Jianjiang Hu, Paola Rizzi, Maximilian Fichtner, Pietro Moretto, Carlo Luetto, Mauro Sgroi, Marcello Baricco "Role of hydrogen tanks in the Life Cycle Assessment of fuel cell-based Auxiliary Power Units" Applied Energy 215 (2018) pp. 1-12; DOI:10.1016/j.apenergy.2018.01.095
4) N. Belmonte, S. Staulo, S. Fiorot, C. Luetto, P. Rizzi, M. Baricco, "Fuel cell powered octocopter for inspection of mobile cranes: design, cost analysis and environmental impacts", Applied Energy 215 (2018) 556-565, DOI: 10.1016/j.apenergy.2018.01.095
5) Mattia Costamagna, Jussara Barale, Claudio Carbone, Carlo Luetto, Alessandro Agostini, Marcello Baricco, Paola Rizzi "Environmental and economic assessment of hydrogen compression with the metal hydride technology" International Journal of Hydrogen Energy 47 (2022) 10122 – 10136 https://doi.org/10.1016/j.ijhydene.2022.01.098
6) Jussara Barale, Erika M. Dematteis, Giovanni Capurso, Bettina Neuman, Stefano Deledda, Paola Rizzi, Fermin Cuevas, Marcello Baricco "$TiFe_{0.85}Mn_{0.05}$ alloy produced at industrial level for a hydrogen storage plant" International Journal of Hydrogen Energy 47 (2022) 29866 – 29880 https://doi.org/10.1016/j.ijhydene.2022.06.295
7) Erika Michela Dematteis, Jussara Barale, Marta Corno, Alessandro Sciullo, Marcello Baricco, Paola Rizzi "Solid-State Hydrogen Storage Systems and the Relevance of a Gender Perspective" Energies 14 (2021) 6158 https://doi.org/10.3390/en14196158
8) Martin Dornheim, Lars Baetcke, Etsuo Akiba, Jose-Ramón Ares, Tom Autrey, Jussara Barale, Marcello Baricco, Kriston Brooks, Nikolaos Chalkiadakis, Véronique Charbonnier, Steven Christensen, José Bellosta von Colbe, Mattia Costamagna, Erika Dematteis, Jose-Francisco Fernández, Thomas Gennett, David Grant, Tae Wook Heo, Michael Hirscher, Katherine Hurst, Mykhaylo Lototskyy, Oliver Metz, Paola Rizzi, Kouji Sakaki, Sabrina Sartori, Emmanuel Stamatakis, Alastair Stuart, Athanasios Stubos, Gavin Walker, Colin J Webb, Brandon Wood, Volodymyr Yartys and Emmanuel Zoulias "Research and development of hydrogen carrier based solutions for hydrogen compression and storage" Progress in Energy 4 (2022) 042005 https://doi.org/10.1088/2516-1083/ac7cb7

Research activities

The research activity was mainly developed at the Department of Chemistry, University of Turin, Italy and collaborations were established with national and international laboratories. She is author of more than 100 publications on international journals. She is leading European projects and research collaboration with SMEs.
The research activity was focused on metallic systems. The amorphous state and the devitrification of the amorphous precursors were studied from

different point of view. Glassy phases were produced mainly by melt spinning or by copper mould casting obtaining both thin ribbons and bulk metallic glasses. The compositions explored were basically Al, Ni, Mg, Fe, Ti, Au based alloys.
Structural and microstructural analyses of amorphous and nanocrystalline alloys were performed by using diffraction techniques and microscopy (both transmission and scanning electron microscopy). Calorimetric analyses were performed by means of differential scanning calorimetry, both conventional and high temperature one, in order to determine the thermal stability of the amorphous phases and metastable crystalline phases. The mechanical properties of amorphous and nanocrystalline materials were studied by performing stress-strain tests, microhardness measurements and by studying fracture surfaces.
Nanoporous metals are synthesised by means of dealloying gold based crystalline and amorphous precursors. Their catalytic properties were studied in different conditions; moreover, nanoporous Gold produced in various conditions was studied as substrate for SERS, demonstrating its good response.
Hydrogen: alloys for hydrogen storage and integrated systems. This part of the research is focused on: i) study of materials for hydrogen storage, in particular intermetallic alloys; ii) design of integrated systems.
The intermetallic alloys studied are mainly of the type AB5 (LaNi5), AB2 (TiMn2), AB (TiFe). The study is focused on the optimization of the compositions using substituents of elements A and B in order to increase the amount of hydrogen absorbed and to adapt the absorption/desorption temperatures and pressures to the needs of the final application. In fact, the substituents lead to variations in the equilibrium T/p pair since, by varying the parameters of the elementary cells of the alloy, they promote or make it more difficult the presence of hydrogen atoms in the interstices of the alloy and lead to the formation of different hydride phases. For the optimization of the alloys, all the classical experimental techniques for the study of metal alloys are exploited (structural, microstructural and calorimetric techniques) together with techniques for determining the properties of hydrogen absorption/desorption such as volumetric equipment of the Sievert type (PCI) and HP-DSC (High Pressure Differential Scanning Calorimeter).
In general, when the design of an integrated system is carried out, boundary conditions are set which depend on the elements that are connected. This therefore leads to having to adapt the alloy to the needs of the system. For example, in the H2FC regional project, a coupled tank-Fuel Cell (FC) system was implemented in which desorption is promoted by exploiting the cooling water of the FC. The desorption temperature was then fixed at 60°C and the most suitable alloy for the application was determined to be LaNi4.8Al0.2 with suitable desorption temperatures and pressures.
As part of the European HyCare project, a prototype of an integrated system is being developed for the accumulation of 50 kg of H2 through renewable energy coupled to heat accumulation systems with the use of PCM (Phase Change Materials). The study of the alloy for hydrogen storage starts in this case from the need to have alloys without CRM (Critical Raw Materials) and of limited cost with absorption/desorption T and p fixed by the system at 50°C

and 2-30 bar. The TiFe0.85Mn0.05 alloy was therefore optimized for which the storage characteristics were studied both at the laboratory level and at the industrial production level to get as close as possible to a large-scale application of the prototype.
The H2 refill station for cylinders to be used on drones with long flight times, designed as part of the Dronhy project and subsequently implemented in collaboration with the SMEs themselves, provides for the integration of photovoltaic panels with an electrolyser and a compressor solid that allows the cylinder to be filled with H2 at 250bar. In this case, the powder must be characterized by high desorption pressures with equilibrium temperatures below 150°C. A new line of research has therefore been opened for the determination of compositions with equilibrium pressures greater than 350 bar at a temperature of 100 - 150°C.
Sustainability. The growing attention to environmental issues has led to the opening of a new line of research linked to the study of environmental impacts through Life Cycle Analysis (LCA). The study is related to the projects described above in which integrated systems for hydrogen storage have been developed. In this case, the LCA analysis makes it possible to determine whether the developed systems are not only effective from the point of view of the exploitation of hydrogen, but are also competitive from an environmental point of view compared to alternative technologies already on the market. The analysis showed that the greatest impacts are often linked to the use of steel in cylinders and that the storage of solid-state hydrogen leads to reduced environmental impacts compared to the accumulation of energy through the use of batteries.