

## PERSONAL INFORMATION

## Annalisa Paolone



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## WORK EXPERIENCE

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- 14 April 2008 - present **Permanent Researcher (III level) of Consiglio Nazionale delle Ricerche, now at Istituto dei Sistemi Complessi (UoS La Sapienza), Roma**  
CNR - National Research Council, Institute for Complex Systems, UoS La Sapienza, P.le A.Moro 5, Rome, [www.isc.cnr.it](http://www.isc.cnr.it)  
Investigation of the physical properties of innovative materials for energy  
**Sector Research**
- 16 October 2004 – 13 April 2008 **Tenure Track Researcher at Istituto Nazionale per la Fisica della Materia**  
Istituto Nazionale per la Fisica della Materia, Laboratorio Regionale Supermat, Baronissi, Salerno  
▪ Investigation of the superconducting materials by means of spectroscopic techniques  
**Sector Research**
- 7 April 2003 – 15 October 2004 **Fixed Term Researcher at Istituto Nazionale per la Fisica della Materia**  
Istituto Nazionale per la Fisica della Materia, Unità Roma 1, P.le A.Moro 5, Rome  
▪ Anelastic spectroscopy of nanostructured carbon  
**Sector Research**
- 1 April 1999 – 31 March 2003 **Fellow, Assegnista di Ricerca at Istituto Nazionale per la Fisica della Materia**  
Istituto Nazionale per la Fisica della Materia, Unità Roma 1, P.le A.Moro 5, Rome  
▪ Measurements of anelastic spectroscopy  
**Sector Research**
- 1999 - 2010 **Lecturer at University La Sapienza of Rome**  
University La Sapienza, P.le A.Moro 5 Rome, [www.sapienza.it](http://www.sapienza.it)  
▪ 11 Courses at the Faculty of Engineering of University La Sapienza:  
A.Y. 1999-2000  
Fisica Generale I for the Diploma "Environmental Engineering"  
A.Y. 2000-2001  
Fisica II for the Diploma "Information Technology Engineering"  
A.Y. 2001-2002  
Mechanics and Thermodynamics for Mechanical Engineering in Latina  
A.Y. 2001-2002  
Laboratory of Physics for Mechanical Engineering in Latina  
A.Y. 2002-2003  
Mechanics and Thermodynamics for Mechanical Engineering in Latina  
A.Y. 2002-2003  
Laboratory of Physics for Mechanical Engineering in Latina  
A.Y. 2004-2005  
Mechanics and Thermodynamics for Mechanical Engineering in Latina  
A.Y. 2006-2007  
Mechanics and Thermodynamics for Mechanical Engineering in Latina

A.Y. 2007-2008  
 Mechanics and Thermodynamics for Mechanical Engineering in Latina  
 A.Y. 2008-2009  
 Electromagnetism for Mechanical Engineering in Latina  
 A.Y. 2009-2010  
 Electromagnetism for Mechanical Engineering in Latina

**Sector Teaching**

1 October 1998 – 31 March 1999 **Fixed Term Researcher at Centre Nationale de la Recherche Scientifique**  
 Laboratoire pour l'Utilization du Rayonnement Electromagnetique, Orsay, France

- Infrared spectroscopy on layered materials

**Sector Research**

1 October 1997 – 30 September 1998 **Fixed Term Researcher Engineer at Centre Nationale de la Recherche Scientifique**

Laboratoire pour l'Utilization du Rayonnement Electromagnetique, Orsay, France

- Infrared spectroscopy on layered materials

**Sector Research**

1 October 1996 – 30 September 1997 **Fellow of Centre Internationale des Etudiantes et Stagiaires**  
 Laboratoire pour l'Utilization du Rayonnement Electromagnetique, Orsay, France

- Infrared spectroscopy of high Tc materials

**Sector Research**

**EDUCATION AND TRAINING**

1 November 1994 – 31 October 1997 **PhD in Material Science**  
 Università di Roma La Sapienza, Piazzale A. Moro 5, Roma

Final discussion on May 15<sup>th</sup> 1998

- Experimental PhD thesis on :“Infrared Spectroscopy of Polaronic Oxides”

1988 - 1993 **Degree in Physics**  
 Università di Roma La Sapienza, Piazzale A. Moro 5, Roma

Final discussion on October 28<sup>th</sup> 1993

Marks 110/110

Experimental thesis on polarons in a high Tc superconductor revealed by infrared spectroscopy.

**PERSONAL SKILLS**

Mother tongue(s) Italian

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1
French	C1	C1	C1	C1	C1

## RESEARCH ACTIVITIES

### Research sector

The research activity of A. P. has been devoted to the study of materials by means of several experimental techniques, more recently supported also by a computational activity.

During the Degree and Ph.D. thesis A. P. studied high temperature superconductors and related materials by means of infrared spectroscopy. The most original contribution in this field was the detection of polaronic bands, due to the strong electron-phonon interaction, present in cuprates, manganites and nickelates. A. P. spent the last year of the Ph.D. thesis at Synchrotron SuperACO of Laboratoire pour l'Utilisation du Rayonnement Electromagnetique (Orsay, France), using the Infrared Beamline of that facility. She stayed there an additional one year and a half, studying manganites by means of infrared spectroscopy (and deepening the knowledge of the properties of synchrotron radiation emitted by storage rings (SR). She evidenced that SR can be produced also by the longitudinal acceleration of electrons or positrons in an accumulation rings. This fact is nowadays the basis for the exploitation of SR in the infrared range by most of Infrared beamlines in Europe.

Come back to Rome as a fellow of INFM, A. P. investigated high temperature superconductors by means of anelastic spectroscopy. The main contribution of this research is the detection of a cluster spin glass state in the low doping regime of LaSrCuO samples, even for Sr concentrations below the usually accepted boundary for the transition towards a spin glass state. Anelastic spectroscopy was used also to investigate other materials such as Zr-D, MnAs, calixarene. During the same period, thanks to her collaborations in France, A. P. studied also the physical properties of some materials potentially applicative as electrodes of lithium batteries. In particular  $\text{LiMn}_2\text{O}_4$  was studied by means of anelastic, Raman and EXAFS spectroscopy. A combined study by means of differential scanning calorimetry and anelastic spectroscopy proved for the first time that in  $\text{Li}_{1-x}\text{Mn}_{2-x}\text{O}_4$  the detrimental phase transition around room temperature could be shifted towards lower temperatures by means of doping, opening new perspectives in the use of this material.

In 2003 A. P. started a study of various materials for solid state hydrogen storage, by means of anelastic spectroscopy, differential scanning calorimetry and thermogravimetry. The main achievements in this field can be summarized as follows:

- Proposition of a model for the dehydrogenation of alanates and for the role of the catalyst in the sorption mechanism;
- $\text{LiN}_3$ : beside hydrogen, it releases a considerable amount of undesired  $\text{NH}_3$ ;
- $\text{NH}_3\text{BH}_3$ : when infused in nanoporous silica, ammonia borane dehydrogenates at much lower temperature and its structural properties are deeply modified with the suppression of the structural phase transition at low temperatures;
- Fullerenes: when doped with LiH or NaH fullerene undergoes a strong structural change with the suppression of rotational dynamics.

A. P. investigated the mechanical properties of new types of polymeric membranes for fuel cells, based on Nafion or cellulose.

In the last years, in the framework of a FIRB project, hydrides were investigated as innovative anodes for lithium batteries. A. P. was in charge for the synthesis and activation of a large number of hydrides and was involved in the theoretical study of the conversion reaction occurring in lithium cells. During the same period A.P. also investigated the physical properties of new electrodic materials for lithium cells, such as  $\text{LiMn}_{1.5}\text{Ni}_{0.5}\text{O}_4$  and  $\text{LiCoPO}_4$ , evidencing a strict correlation between the structure and the functional properties of those materials.

In the last five years, thank to a fruitful international collaboration in the USA, A. P. investigated the sorption properties of amorphous metallic membranes for hydrogen. In the last three year she extended such study to crystalline materials in collaboration with ENEA, Frascati.

A large part of the most recent research activity has been devoted to the study of ionic liquids. These materials have attracted much interest as electrolytes, solvents, lubricants and their macroscopic properties have been largely investigated in the literature. However, a deep comprehension of the link between macroscopic and microscopic properties is still need and the research of A.P. is devoted to deepening such knowledge, by means of infrared spectroscopy, dynamical mechanical analysis and differential scanning calorimetry. Moreover, in order to interpret experimental data, A. P. developed a computational activity based on two softwares (Spartan and Firefly). The main achievements of this activity are:

- phase transition are deeply modified by the interaction with polymeric membranes;
- the concentration of different conformers of both anions and cations is modified by the occurrence of phase transition as a function of both temperature and pressure;
- the occurrence of phase transitions can be tailored by the competitive interactions of different

conformers of ions.

Web of science H-index: 24, Citations: 1800; author of about 170 papers, contributor to more than 20 conferences,

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Scopus Author ID: 7005778507

WoS Researcher ID: B-7701-2015

#### Main Collaborations

[REDACTED]

#### Main Projects

- 1 Horizon H2020 "Silicon Alloying Anodes for Energy Dense Batteries comprising Lithium Rich Cathodes and Ionic Liquid Electrolytes for Safe High VoltagE Performance"- Si DRIVE, Call LC-NMBP-30-2018, Materials for future highly performant electrified vehicle batteries (RIA), Role: **Scientific Director** of the CNR Unit
- 2 FIRB 2010 -"Hydrides as high capacity anodes for lithium batteries", funded by the Italian Ministry of Research, 2012-2017, Role. Member of the CNR-ISC unit
- 3 2011-2014 APPLES - "Advanced, High Performance, Polymer Lithium batteries for Electrochemical Storage", Funded by the European Commission (FP7), Project ID: 265644  
Role: member of the HydroEco unit;
- 4 2010-2013 "Hydrostore", funded by the Italian Ministry of Economic Development in the framework of "Industria 2015-bando Efficienza energetica"  
Role: **Scientific Director** of the Hydro-Eco unit;
- 5 Ateneo 2010 "Synthesis and physical chemical characterizations of proton conducting, nano-composite polymer electrolytes for fuel cell applications." Sapienza Università di Roma, Member of the Unit
- 6 2007 – 2010 Project "Idrogeno come vettore energetico ecologico alternativo: immagazzinamento a stato solido", funded by the Ministry of the Environment, Role: member of the University of Rome la Sapienza Unit
- 7 2000-2006 POR Sicilia - "Nanomateriali per il Settore Energetico-Ecologico, Role: Member of the CNR Unit
- 8 PRIN 2004 "Sintesi e caratterizzazione di materiali per l'immagazzinamento di idrogeno allo stato solido", Role: Member of the Unit,
- 9 FIRB 2001 "Nanostructured carbon", Role: Member of the Unit
- 17 PRA 1999-2001 "Spectroscopic Studies of the Pseudogaps in Underdoped High temperature Superconductors", funded by Istituto Nazionale per la Fisica della Materia, Role: Member of the Unit

Responsible for the Laboratory Nanomaterials for Energy of CNR-ISC located at Sapienza University of Rome

Scientific Director of CNR Unit in the Project Horizon H2020 "Silicon Alloying Anodes for Energy Dense Batteries comprising Lithium Rich Cathodes and Ionic Liquid Electrolytes for Safe High VoltagE Performance"- Si DRIVE

Member of the Scientific Committee of the Conferences "International Conference on Internal Friction and Mechanical Spectroscopy" ([www.icifms18.com.br](http://www.icifms18.com.br))

Guest Editor of the Special Issue "**Innovative Materials for Energy Storage**" in the journal Molecules ([https://www.mdpi.com/journal/molecules/special\\_issues/materials\\_ener-storage](https://www.mdpi.com/journal/molecules/special_issues/materials_ener-storage))

Referee for several journals including Journal of Power Sources, Physical Review Letters, Physical Review B, Journal of Physical Chemistry, Nanoscale, Chemistry of Materials, Electrochemistry Communications, Journal of Physics: Condensed Matter, Journal of Magnetism and Magnetic Materials, Journal of Physics and Chemistry of Solids, Materials Science & Engineering, Applied

Surface Science, Journal of Solid State Chemistry, Physica B, Materials, Batteries.

In September 2010 obtained the habilitation in the Comparative Evaluation as Associate Professor FIS/01 at Politecnico di Milano, Prot. 22544 Pos. VII/1 (September 2<sup>nd</sup> 2010)