

CURRICULUM VITAE

EUROPEAN FORMAT

PERSONAL INFORMATION

Name, Surname	Mauro Murgia
Indirizzo/Address	
Telephone	+390516398528
Fax	+390516398540
E-mail	mauro.murgia@cnr.it
Website	http://www.ismn.cnr.it
Nationality	Italiana
Luogo e data di nascita/ Place and Date of birth	Brescia (BS) 16/09/1964

PROFESSIONALE EXPERIENCE

Dates (from – to)	01/04/2017 to date
Occupation or position held	Contract Scientist
Main activities and responsibilities	Planning and building the new neurotechnology lab including project, development and building a High vacuum system with two independent chambers and pumping unit designed for the fabrication of a whole-organic device. The system, equipped with three Knudsen cells and two thermo-joule sources is connected with a two-chamber glove box in Argon. The entire system is connected with a computer assisted system integrated with Agilent SMU for electrical characterization of organic devices like OFET, EGOFET, OECT. Subsequently I equipped the lab with two spin coaters -one in the glove box and one under a laminar flow hood- used with water based formulations (e.g. PEDOT-PSS or PEDOT -NAFION). The devices are manufactured on biocompatible/biodegradable flexible polymers e.g. Polyimide, will be used in neurophysiology experiments performed in the IIT Centre. I worked on the development of an electromedical device for recording and stimulation with direct DC current on nervous tissue, whereby I designed ultra-low noise current/tension converter that will be integrated in the device.
Name and address of employer	Istituto Italiano di Tecnologia IIT-Centro di Neurofisiologia Traslazionale -Via Fossato di Mortara 19, 44121 Ferrara (FE)
Type of business or sector	Research
Dates (from – to)	25/07/2011 to date
Occupation or position held	Senior Technologist researcher
Main activities and responsibilities	Responsible for High Vacuum (HV) and Ultra High Vacuum (UHV) OMBD growth facilities in ISMN. I contributed to research activities by creating, designing and manufacturing new scientific instruments and technological solutions, often beyond the state of the art. These experiments resulted into a large number of scientific papers and the innovative setups were described in CNR reports. Some of these setups were

		built for Universities. For instance, I realized a variety of sources for organic or metal evaporation, other sources are to be used under Hydrogen pressure; ultra-high vacuum equipment (sample holders, actuators, manipulators); two vacuum systems; two-chamber setup equipped with tools for performing photocurrent measurements at different temperatures, the first with nitrogen atmosphere and the second in vacuum. I tutored and trained the activities of students during their PhD.
Name and address of employer		CNR-ISMN Via P. Gobetti 101 ,40129, Bologna
Type of business or sector		Research
Dates (from – to)		15/06/2001 to 25/07/2011
Occupation or position held		Technologist researcher
Main activities and responsibilities		Responsible for High Vacuum (HV) and Ultra High Vacuum (UHV) OMBD laboratories. I have been working on different topics, spanning from the study of fundamental properties of oligothiophenes to Light emitting devices with organic semiconductors (OLET) , I developed and realized a variety of scientific tools to improve the results and the quality of the research in my group. Among the most relevant ones, I built a train sublimation system, a liquid cooled source for metal evaporation, a complete computer-assisted system to perform real time in situ electrical measurements, a high vacuum system connected with a glove box. During this period I also tutored and trained students during their PhD.
Name and address of employer		CNR- ISMN Via P. Gobetti 101, 40129, Bologna
Type of business or sector		Research
Dates (from – to)		11/1996 to 15/06/2001
Occupation or position held		Contract Technologist with Contract ex-art 23 del DPR 171/91. CTER V Livello – Collaboratore tecnico degli Enti di Ricerca.
Main activities and responsibilities		Developing and building the first UHV Organic Molecular Deposition laboratory at CNR Bologna (second of this kind in the world); Inventing two types of Knudsen Cell for sublimation of organic semiconductors (both patented and licensed to third party).
Name and address of employer		CNR-ISM Via P. Gobetti 101 , 40129, Bologna
Type of business or sector		Research
Dates (from – to)		05/1995 to 11/1996
Occupation or position held		Contract Technical expert.
Main activities and responsibilities		Setting up the hardware and software for quartz microbalance measuring system for HV and UHV chambers. Realization of a new in-situ stage for electrical measurements on organic electronics devices and photocurrent measurements.
Name and address of employer		CNR-ISM Via P. Gobetti 101, 40129, Bologna
Type of business or sector		Research
Dates (from – to)		10/1992 to 05/1995
Occupation or position held		Responsible of corporate electronic department
Main activities and responsibilities		The core business of the company was developing and manufacturing electronic devices in the field of green and sustainable energy (photovoltaic modules and wind turbines) by using exclusively low power MOS technology. I was involved mainly in the development and realization of customized prototypes
Name and address of employer		IDEA Srl, Via della tecnica San Lazzaro di Savena-Bologna-Italy
Type of business or sector		Trade and industry
Dates (from – to)		10/1991-05/1992
Occupation or position held		High school teacher “IPSIA Istituto Professionale di Stato Industria e Artigianato”. Title of the class: Sistemi automatici di controllo. Elettronica per informatici.
Name and address of employer		IPSIA via Assisana 40, 06035 Perugia.
Type of business or sector		Teaching

EDUCATION AND TRAINING

Dates (from – to)	21/04/1997 to 27/04/1997
Name and type of organization providing education and training	Associazione Italiana del Vuoto-Istituto Metrologico “Colonnetti”
Principal subjects occupational skills covered	Qualificazione sulle prove non distruttive: Rivelazione delle perdite
Dates (from – to)	1995 to 1999
Name and type of organization providing education and training	CNR-ISM under the supervision of Prof. Carlo Taliani (CNR Research Director) and Dr. Oleg Kapousta, Research Engineer of the Russian Academy of Sciences-The Institute of Chemical Physics, Troisk (Russian Federation), then visiting scientist at CNR.
Principal subjects occupational skills covered	UHV technology for Organic Materials: Physics of organic semiconductors and organic electronics fundamentals (electronic structure, charge and energy transport, charge injection), device physics and optoelectronics properties. UHV setup design; function and assembly of UHV components, TIG welding and manufacturing, maintenance of chambers and pumping systems, leak detection and failure repairs; principles of UHV physics, Knudsen effusion, cell design, thickness monitoring, growth modes and theories, epitaxy; surface preparation and functionalization.
Title of qualification awarded	N/A
Dates (from – to)	1985 to 1990
Name and type of organization providing education and training	Università Statale degli Studi di Milano
Principal subjects occupational skills covered	Electronic and Solid state physics studies with inorganic devices characterization, traps in MoSi ₂ oxides, FORTRAN programming.
Title of qualification awarded	Laurea in Physics (vecchio ordinamento) which gives the right to be Doctor of Physics.

RESEARCH ACTIVITIES

My professional (almost)-25-year-long research experience is characterized by the capability to develop and integrate technology in important scientific problems that require sophisticated instrumentation beyond the state-of-the-art. This skill has allowed me to play a central role in the research activities of several research groups in CNR, Universities and IIT. The original solutions and the innovation I was able to introduce in the research enabled the performance of unprecedented experiments that lead to numerous papers, technical reports, and patents, of which some transferred to companies including start-up. I also formed young technical engineers to start a career in some of the groups where I was active.

Since the early nineties, I started to design and develop systems and equipment for thin film growth of organic semiconductors by sublimation in High Vacuum (HV) and Ultra High Vacuum (UHV). This was a very new and emerging field in those years, with the advent of the first polymer light emitting diodes and organic transistors. At that time, only Molecular Beam Epitaxy MBE systems for inorganic semiconductors (e.g. III-V) were available. In this context, I developed and built the first organic MBE, termed organic molecular beam deposition (OMBD) in Europe, few months later the first OMBD started operations in Princeton University. My OMBD setup produced a wealth of scientific publications and patents, because the new Knudsen Cells I designed (Patents 2,3) then transferred to the spin off Organic Spintronic, allowed us to achieve thermo-sublimation under molecular beam regime of organic molecules. The OMBD facility produced OLEDs, OFETs and the first photovoltaic cells made by co-evaporation of two molecular species simultaneously sublimated in UHV (C60 / ZnPc was published on The Journal of Chemical Physics, vol. 116, p. 1713-1719 2002), and boosted the organic electronics research in CNR-ISMN who became internationally-leading center in this field.

Within the European project MONA LISA (GRD1-2000-25592) I optimized the growth technology for thin films of rigid-rod molecules (thiophene oligomers), and in 2004 for the first time, thanks to the unprecedented control on film thickness down to 0.1 monolayers, we experimentally demonstrated that the charge transport in α -T6 thin film occurs within the first two monolayers adsorbed the gate dielectric (Physical Review Letters 92, 116802 2004). This result was the very first experimental demonstration of the physical size of the charge transport layer, that opened a fertile research on organic transport in thin films, and inspired many experiments aimed to elucidate the universal aspect of growth phenomena on charge transport properties of organic semiconductors. This work received to date about 600 citations.

Furthermore, I developed a method for patterning anisotropic domains of thin films made of conjugated molecules, with the aim to impart enhanced structural, electrical, optical and opto-electronic properties to thin films of conjugated materials (patent 1). This patent was licensed to the new start-up company Scriba Nanotecnologie Srl (founded in 2005 and still active).

In 2006, within the ILO EU-IST-2001-33057 project, I was responsible for designing and integrating a glove box operated at 1 ppm O₂ content to an existing High Vacuum chamber (CNR Technical report 06/02/15). This setup became central to the projects ILO and OLAS where I was responsible for the growth of OFETs used as lighting elements and active components in electrically pumped organic lasers (OLET).

In 2006 within the EU project EU-IST015034-OLAS I developed and built a train sublimation system realized with three different heating stages for the purification of organic semiconductors (Technical report CNR-ISMN 0002070, Advanced Functional Materials 16 (1), 41-47 2006).

In 2009-2011 I was involved in the EU-FP7-NMP-LARGE 212311 project ONE-P where I developed a multi pin sample holder for UHV in-situ electrical measurements, that could be heated up to 150°C and cooled up to -150°C (CNR technical report 0002071 and Review of Scientific Instruments 82 (2), 025110 2009). This instrument allowed us to expand the research on the fundamental aspects of charge transport in organic semiconductor during thin film growth (ref. 10).

During the three years of the project EU-FP7 I-ONE-FP7 (Implantable Organic Nano-Electronics) whose mission was a device treatment of Spinal Cord Injury (SCI) with the use of flexible implantable organic biocompatible / biodegradable electronics devices, I made four-channel multiplexer able to drive arrays of organic transistors, perform sharp and fast measurements of ultra-small electrophysiological signals from neuronal cell cultures (ref7). I was also involved on the optimization of the laser ablation technique used to pattern Au microelectrodes from Au thin films.

In 2016 in collaboration with the Physics Dept. University of Bologna I designed, developed, and manufactured a chamber with controlled atmosphere devoted to photocurrent measurements. The sample stage features a home-built cooling/heating system with a Peltier cell working in the range from -15°C to +65 °C (Technical report CNR-ISMN 0004577).

Since 2017 I am involved in the EU-H2020 ID 732678 project MAgnetic DIAgnostic assay for neurodegenerative diseases -MADIA- where I developed and built an innovative device based on variable and adaptable external magnetic fields, involving moving permanent magnets. The system is capable to efficiently manipulate, separate and concentrate analytes diluted down to the fg/mL level in aqueous solutions and biological fluids even in geometrically complex environments.

Recent Scientific Activities

In 2018 I started a collaboration with Istituto Italiano di Tecnologia (IIT). The task was to setup a new lab dedicated to Organic Neurotechnologies. I contributed to the project by drawing, assembling and tuning a two-chamber HV system equipped with three Knudsen cell and 2 thermal sources for metals and inorganic substances (e.g. oxides), interconnected with a two-chamber glove box filled with Argon and 1 ppm O₂. The system is also equipped with a home-built setup for electrical measurements on organic devices completely computer assisted with special micromanipulators for probes.

In 2019 within the project JOINT LAB CTNCS@IIT and EMS MEDICAL-ETCM040801 I had the task to develop specific electronic devices to be used with instrumentation for stimulation and recording of nervous tissue signals. I developed a very low noise DC power supply to be coupled to biocompatible devices for in vitro and in vivo experiments.

During the same year, I started a collaboration with the the Department of Biomedical and Surgical Sciences at the University of Ferrara on the project Neurophysiology of Sensorimotor Communication. I contributed by optimizing the sensor used during tactile experiments.

Since April 2020 I am contract researcher in IIT . My research plan is to build a novel prototyping laboratory of new generation, inspired by effectiveness, space and environmental requirement, and diversity of the materials to be patterned and integrated. The ultimate goal will be to prototype neuromorphic devices and ECoG arrays on ultra-flexible substrates for the translational experiments. The new machine will be also pave the grounds, in the future, for light, friendly machines for personalization of implantable neuro-devices that could end up into hospitals and surgery rooms. This project is ambitious since it will enable to standardize the quality, reliability and processability of the devices and explore different layouts for new experiments. The machine will encompass the potential of a full fabrication line in clean room, in a benchtop configuration that could be installed and used also in non ideal contexts Other important feature, that strongly motivates the effort, are the affordable running and maintenance costs, as well as the accessibility to not specialized technologists.

The idea behind my project is to standardize and optimize the processes normally used for thin film preparation with wet methods, by integrating them in a single machine that will include also powerful tools for additive and subtractive patterning. The possibility to integrate different techniques in a single platform will allow us to achieve unprecedented layouts, performances and ultimately scientific results. All these facilities, included in single fully automated system capable of a wide range of techniques for the preparation and treatment of thin films and substrates will become a benchmark for the state of the art in micro and nanofabrication technology of soft matter and hybrid devices.

Outreach Activities

I spent part of my activity to outreach initiatives for young students. Starting from 2017 within the project RM@School “Raw Matters Ambassadors at Schools “ I developed and built a toolkit based on neodimium magnets in order to perform experiments on electromagnetism, to be used with high school students in physics classes. Those experiments and the whole toolkit was presented at

The IDEEN exp 2017÷2019 in Hannover (DE) and at the Festival della Scienza 2019 in Genoa where students involved visitors in experiments to stimulate awareness on the usage of Raw Materials and related problems.

Bibliometric Indicators

Papers on peer-reviewed journals and book chapters **122**; Source: Google Scholar 10/12/2019: **Number of citations > 5092 h-index=36**

Granted Patents

1. Fabrication method at micrometer- and nanometer- scales for generation and control of anisotropy of structural, electrical, optical and optoelectronic properties of thin films of conjugated materials” priority number MI2001A002075 on

08/10/2001; PCT/EP02/11218 on 07/10/2002; CN grant of patent No. ZL 02819781.X on 18/02/2009

2. Realizzazione di una cella di effusione a temperatura uniforme a singolo filamento” Priority number BO99A-00059 on 14/11/1999; PCT/EP 01311129 on 4/03/2002
3. Realizzazione di una cella di effusione a gradiente di temperatura a singolo filamento” Priority number BO2000A-000272 on 15/05/2000 PCT/EP 01321252 on 8/01/2004

Selected publications in Organic Electronics and Bioelectronics in the last 10 Years

1. Stefano Carli, Michele Di Lauro, Michele Bianchi, Mauro Murgia, Anna De Salvo, Mirko Prato, Luciano Fadiga, Fabio Biscarini “*Water-based PEDOT: Nafion Dispersion for Organic Bioelectronics*” ACS Applied Materials & Interfaces 2020,12. 29807-29817
2. Michele Bianchi, Stefano Carli, Michele Di Lauro, Mirko Prato, Mauro Murgia, Luciano Fadiga and Fabio Biscarini “*Scaling of Capacitance of PEDOT:PSS: Volume vs Area*” J. Mater. Chem. C, 2020, DOI:10.1039/D0TC00992J
3. *Michele Di Lauro*;* Anna De Salvo; Gioacchino Calandra Sebastianella; Michele Bianchi; Stefano Carli ;Mauro Murgia; Luciano Fadiga and Fabio Biscarini “*Tunable Short-Term Plasticity Response in Three-Terminal Organic Neuromorphic Devices*” ACS Applied Electronic Materials.
4. Michele,Di Lauro; Simona, la Gatta; Mauro Murgia; et al. “*A Bacterial Photosynthetic Enzymatic Unit Modulating Organic Transistors with Light*” Advanced Electronic Materials :6 (1), 1900888 DOI: 10.1002/aelm.201900888
5. Stefano Carli; Michele Bianchi; Elena Zucchini; Michele Di Lauro; Mirko Prato; Mauro Murgia; Luciano Fadiga,; Fabio Biscarini;”*Electrodeposited PEDOT:Nafion Composite for Neural Recording and Stimulation*” Advanced Healthcare Materials 8,19, 1900765 (2019)
6. Decataldo, Francesco; Cramer, Tobias; Martelli, Davide; Mauro Murgia; et al.”*Stretchable Low Impedance Electrodes for Bioelectronic Recording from Small Peripheral Nerves*” Scientific Reports 9,10598 (2019)
6. Di Lauro M., Casalini S.; Berto M.; Campana A.; Cramer T.; Mauro Murgia.; Geoghegan M.; Bortolotti C.A.; Biscarini F. “*The Substrate is a pH-Controlled Second Gate of Electrolyte-Gated Organic Field-Effect Transistor*” ACS Applied Materials & Interfaces 8, 46 (2016).
7. Cramer T.; Kyndiah A.; Kloes A.; Mauro Murgia.; Fraboni B.; Biscarini F. “*Charge density increase in submonolayer organic field-effect transistors*” Physical Review B, Condensed matter and materials physics 91, 20 (2015).
8. Desbief, Simon; Kyndiah, Adrica; Guerin, David; Gentili, Denis; Mauro Murgia; Lenfant, Stephane; Alibart, Fabien; Cramer, Tobias; Biscarini, Fabio; Vuillaume, Dominique “*Low voltage and time constant organic synapse-transistor Organic electronics*” Organic Electronics 21 (2015).
9. A. Campana, T. Cramer, P. Greco, G. Foschi, Mauro Murgia, F. Biscarini “*Facile maskless fabrication of organic field effect transistors on biodegradable substrates*” APL 103, 073302-073302-4 (2013).

10. T. Cramer, A. Campana, Mauro Murgia et al "*Water-Gated Organic Field Effect Transistors – Opportunities for Biochemical Sensing and Extracellular Signal Transduction*" J. Mater. Chem. B 1, 3728-3741 (2013)
11. T. Cramer, B. Chelli, Mauro Murgia, M. Barbalinardo, E. Bystrenova, D. M. de Leeuw, F. Biscarini "*Organic Ultra-Thin Film Transistor with Liquid Gate for Extracellular Stimulation and Recording of Electric Activity of Stem Cell-Derived Neuronal Networks*" Phys. Chem. Chem. Phys.15, 3897-3905 (2013).
12. M Cavallini, Z Hemmatian, A Riminucci, M Prezioso, V Morandi, Mauro Murgia "*Regenerable resistive switching in silicon oxide based nanojunctions*" Advanced Materials 24 (9), 1197-1201
13. T. Cramer, A. Kyndiah, Mauro Murgia, F. Leonardi, S. Casalini, F. Biscarini "*Double layer capacitance measured by organic field effect transistor operated in water*" Applied Physics Letters 100,14 (2012)
14. SD Quiroga, A Shehu, C Albonetti, Mauro Murgia, P Stoliar, F Borgatti, et al "*A high-vacuum deposition system for in situ and real-time electrical characterization of organic thin-film transistors*" Review of Scientific Instruments 82 (2), 025110
15. Shehu, A, Quiroga, SD, D'Angelo, P, Mauro Murgia. et al. "*Layered Distribution of Charge Carriers in Organic Thin Film Transistors*" Physical Review Letters 104, 24 Article Number: 246602 (2010).