

## CURRICULUM VITAE



### PERSONAL INFORMATION

<i>Name, SURNAME</i>	<b>Filippo GIANNAZZO</b>
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<i>Phone (office)</i>	+39 095 5968242
<i>E-mail</i>	<a href="mailto:filippo.giannazzo@imm.cnr.it">filippo.giannazzo@imm.cnr.it</a>
<i>Nationality</i>	Italian
<i>Place and Data of birth</i>	Enna (Italy), 22/04/1974

### WORK EXPERIENCE

<i>From 15/10/2020 to now</i>	Research Director (Dirigente di Ricerca, I livello, Mat. 10107) Consiglio Nazionale delle Ricerche, Istituto per la Microelettronica e i Microsistemi (CNR-IMM), Catania
<i>From 01/01/2010 to 14/10/2020</i>	Senior Scientist (Primo Ricercatore, II livello, Mat. 10107) Consiglio Nazionale delle Ricerche, Istituto per la Microelettronica e i Microsistemi (CNR-IMM), Catania
<i>From 01/01/2008 to 31/12/2009</i>	Research Scientist (Ricercatore, III livello, Mat. 10107) Consiglio Nazionale delle Ricerche, Istituto per la Microelettronica e i Microsistemi (CNR-IMM), Catania
<i>From 30/12/2005 to 31/12/2007</i>	Research Scientist (Temporary position) Consiglio Nazionale delle Ricerche, Istituto per la Microelettronica e i Microsistemi (CNR-IMM), Catania
<i>From 01/01/2004 to 29/12/2005</i>	Post doc (assegno di ricerca) Consiglio Nazionale delle Ricerche, Istituto per la Microelettronica e i Microsistemi, Catania
<i>From 03/12/2001 to 31/12/2003</i>	Post doc (assegno di ricerca) University of CATANIA – Department of Physics and Astronomy

### EDUCATION AND TRAINING

<i>From 30/04/1999 to 31/10/2001</i>	PhD in Material Science, University of Catania, Italy. Thesis: "Scanning Capacitance Microscopy of Semiconducting Materials". Degree awarded on 04/03/2002
<i>From January to April 2001</i>	Visiting scientist at ETH Zurich
<i>From 01/11/1993 to 10/07/1998</i>	M. Sc. (Laurea) in Physics (110 cum laude). University of Catania, Italy. Thesis: "Linea di spettromicroscopia SUPERMAXIMUM ad Elettra: applicazioni all'analisi di clusters". Tutors: Prof. G. Faraci, Dr. S. La Rosa. Degree awarded on 10/07/1998

## RESEARCH ACTIVITIES

- Nanometer resolution electrical characterization methods based on scanning probe microscopy for the study of charge transport in advanced materials for micro- and nano-electronics (semiconductors heterostructures, wide-bandgap semiconductors, nanostructured metal films, functional oxides, organic materials, graphene and 2D materials).
- Development of advanced processes (ion implantation, contacts, dielectrics) for the fabrication of high power and/or high frequency devices based on wide bandgap semiconductors (SiC, GaN,...).
- Investigation of the electronic properties of graphene and other 2D materials and of their heterostructures with semiconductors (SiC, GaN). Development of high-frequency and energy efficient electronic devices bases on the integration of 2D materials with nitride semiconductors.

## Responsibilities within CNR:

<i>From 01/01/2008 to 31/12/2015</i>	Responsible of the Research Activity ("Modulo") MD.P05.003.004 "Nanotechnologies and advanced technologies for integrated electronics", withing the Reesearch Group ("Commissa") MD.P05.003 "Power devices, RF and passive components for high performance integrated electronics" of CNR-IMM.
<i>From 31/12/2005 to now</i>	Scientific responsible of the Scanning probe microsocopy laboratory at CNR-IMM, Catania.

## Responsibilities within national and international projects:

<i>From 01/04/2020 to now</i>	Coordinator of the EU project ETMOS: "Epitaxial Transition Metal dichalcogenides Onto wide bandgap hexagonal Semiconductors for advanced electronics". Call FlagERA JTC 2019 "Graphene Applications"
<i>From 01/02/2016 to 31/01/2019</i>	Coordinator of the EU project GraNitE: "Graphene heterostructures with Nitrides for high frequency Electronics". Call FlagERA JTC 2015 "Graphene"
<i>From 01/01/2016 to 31/12/2018</i>	Coordinator for CNR-IMM of the Bilateral project GHOST: "Graphene heterostructures with ultra-thin films of wide bandgap semiconductors", in the framework of the CNR-HAS Scientific Cooperation Agreement 2016-2018.
<i>From 31/10/2013 – 31/03/2016</i>	Responsible delle attività del WP8 presso il CNR-IMM di Catania. Flagship GRAPHENE: Graphene-Based Revolutions in ICT And Beyond. Flagship GRAPHENE - Grant Agreement nr. 604391.
<i>From 01/06/2012 to 31/12/2015</i>	Responsible of the research activity "Grafene per TCO" in the PON National project ENERGETIC: "Tecnologie per l'ENERGia e l'Efficienza energETICa" - Grant N° PON02_00355_3391233.
<i>From 01/01/2013 to 31/12/2015</i>	Coordinator for CNR-IMM of the Bilateral project "Novel capacitance and charge transient based scanning probe microscopy methods for analysis of defects in prospective semiconductors and nanostructures", in the framework of the Scientific Cooperation Agreement between CNR and Slovak Academy of Science (SAS) 2013-2015.

<i>From 01/01/2009 to 31/12/2011</i>	Coordinator for CNR-IMM of the Bilateral project “Advanced scanning probe microscopy for analysis of defects in inorganic and organic semiconductors and nanostructures”, in the framework of the II EXECUTIVE PROGRAMME OF SCIENTIFIC AND TECHNOLOGICAL COOPERATION BETWEEN ITALY AND SLOVAKIA FOR THE YEARS 2009-2011.
<i>From 01/02/2016 to 31/01/2019</i>	Co-Investigator of the CNR-IMM Unit in the EU project GRIFONE: “Graphitic films of group III nitrides and group II oxides: platform for fundamental studies and applications”. Call FlagERA JTC 2015 “Graphene”.
<i>From 01/02/2011 to 31/01/2015</i>	Participant to the CNR-IMM Unit in the EU project NetFISiC: “Training NETwork on Functional Interfaces for SiC”. Marie-Curie Initial Training Network (ITN). Project ID 264613
<i>From 01/10/2010 to 30/09/2014</i>	Participant to the CNR-IMM Unit in the National PON project Ambition Power. (Grant N° PON01_00700)
<i>From 01/04/2010 to 30/09/2014</i>	Participant to the CNR-IMM Unit in the EU project LAST POWER “Large Area silicon carbide Substrates and heteroepitaxial GaN for POWER device applications”. ENIAC Joint Undertaking–Grant No. 120218
<i>From 01/01/2010 to 31/12/2013</i>	Co-investigator of the CNR-IMM Unit in the EU project “Graphic-RF: Graphene on SiC wafers for high performant RF transistors”, funded by European Science Foundation withing the EUROGRAPHENE program.
<i>From 01/01/2007 to 31/12/2010</i>	Participant to the CNR-IMM Unit in the EU project MANSiC: "Promoting and structuring a Multidisciplinary Academic-Industrial network through the heteropolytype growth, characterization and applications of 3C-SiC on hexagonal substrates". Marie Curie research training network (RTN). Grant n. MRTN-CT-2006-035735
<i>From 01/01/2007 to 31/12/2007</i>	Participant to the CNR-IMM Unit in the project “Processi Nanostrutturati su Semiconduttori ad Ampia Banda Proibita”. Scientific cooperation programme between Italy and France GALILEO 2007.
<i>From 01/01/2007 to 31/12/2010</i>	Participant to the CNR-IMM Unit in the national project MIUR FIRB 2005 “Tecnologie abilitanti, caratterizzazione e modellistica per componenti elettronici integrati riconfigurabili a banda larga per alta frequenza”. Grant n. RBIP068LNE_001
<i>From 01/01/2001 to 31/12/2003</i>	Participant to the CNR-IMM Unit in the EU project “HERCULAS: High-resolution electrical characterisation of ULSI and advanced semiconductor devices”. Marie Curie RTN. Grant n. HPRN-CT-2000-00031.

## **PUBLICATIONS: BOOK AND ARTICLES**

Dr. F. Giannazzo is author or coauthor of 352 papers in international peer-reviewed journals, 1 book, 10 book chapters and 1 US patent.

*Bibliometric data: H-index=42, Tot citations: 5983 (Source Scopus).*

He is frequently invited speaker in national and international conferences.

## Selected publications (last 10 years):

1. F. Giannazzo, S. E. Panasci, E. Schilirò, P. Fiorenza, G. Greco, F. Roccaforte, M. Cannas, S. Agnello, A. Koos, B. Pécz, M. Spankova, S. Chromik. *Highly homogeneous 2D/3D heterojunction diodes by pulsed laser deposition of MoS<sub>2</sub> on ion implantation doped 4H-SiC*. Advanced Materials Interfaces, 2022. DOI: 10.1002/admi.202201502
2. F. Giannazzo, S. E. Panasci, E. Schilirò, F. Roccaforte, A. Koos, M. Nemeth, B. Pécz. *Esaki Diode Behavior in Highly Uniform MoS<sub>2</sub>/Silicon Carbide Heterojunctions*. Advanced Materials Interfaces 9, 2200915 (2022).
3. S. E. Panasci, E. Schilirò, G. Greco, M. Cannas, F. M. Gelardi, S. Agnello, F. Roccaforte, F. Giannazzo, *Strain, Doping, and Electronic Transport of Large Area Monolayer MoS<sub>2</sub> Exfoliated on Gold and Transferred to an Insulating Substrate*, ACS Appl. Mater. Interfaces 13, 31248–31259 (2021).
4. E. Schilirò, R. Lo Nigro, S.E. Panasci, S. Agnello, M. Cannas, F. M. Gelardi, F. Roccaforte, F. Giannazzo, *Direct Atomic Layer Deposition of Ultrathin Aluminum Oxide on Monolayer MoS<sub>2</sub> Exfoliated on Gold: The Role of the Substrate*, Advanced Materials Interfaces 8, 2101117 (2021).
5. B. Pécz, G. Nicotra, F. Giannazzo, R. Yakimova, A. Koos, A. Kakanakova-Georgieva, *Indium Nitride at the 2D Limit*, Advanced Materials 33, 2006660 (2021).
6. E. Schilirò, R. Lo Nigro, S.E. Panasci, F.M. Gelardi, S. Agnello, R. Yakimova, F. Roccaforte, F. Giannazzo, *Aluminum oxide nucleation in the early stages of atomic layer deposition on epitaxial graphene* Carbon 169, 172-181 (2020).
7. A. Kakanakova-Georgieva, G.K. Gueorguiev, D.G. Sangiovanni, N. Suwannaharn, I. G. Ivanov, I. Cora, B. Pécz, G. Nicotra, F. Giannazzo, *Nanoscale phenomena ruling deposition and intercalation of AlN at the graphene/SiC interface*, Nanoscale 12, 19470-19476 (2020).
8. F. Giannazzo, G. Greco, E. Schilirò, R. Lo Nigro, I. Deretzis, A. La Magna, F. Roccaforte, F. Iucolano, S. Ravesi, E. Frayssinet, et al., *High-performance graphene/AlGaN/GaN Schottky junctions for hot electron transistors*, ACS Appl. Electron. Mater. 1, 2342-2354 (2019).
9. A. Armano, G. Buscarino, M. Cannas, F.M. Gelardi, F. Giannazzo, E. Schilirò, R. Lo Nigro, S. Agnello, *Influence of oxide substrates on monolayer graphene doping process by thermal treatments in oxygen*, Carbon 149, 546-555 (2019).
10. F. Giannazzo, *Engineering 2D heterojunctions with dielectrics*, Nature Electronics 2, 54-55 (2019).
11. A. Armano, G. Buscarino, M. Cannas, F.M. Gelardi, F. Giannazzo, E. Schilirò, S. Agnello, *Monolayer graphene doping and strain dynamics induced by thermal treatments in controlled atmosphere*, Carbon 127, 270-279 (2018).
12. G. Greco, P. Fiorenza, F. Iucolano, A. Severino, F. Giannazzo, F. Roccaforte. *Conduction Mechanisms at Interface of AlN/SiN Dielectric Stacks with AlGaN/GaN Heterostructures for Normally-off High Electron Mobility Transistors: Correlating Device Behavior with Nanoscale Interfaces Properties*, ACS Appl. Mater. Interfaces, 2017, 9 (40), pp 35383–35390.
13. F. Giannazzo, G. Fisichella, G. Greco, S. Di Franco, I. Deretzis, A. La Magna, C. Bongiorno, G. Nicotra, C. Spinella, M. Scopelliti, B. Pignataro, S. Agnello, F. Roccaforte, *Ambipolar MoS<sub>2</sub> Transistors by Nanoscale Tailoring of Schottky Barrier Using Oxygen Plasma Functionalization*, ACS Appl. Mater. Interfaces 9, 23164–23174 (2017).
14. G. Fisichella, E. Schilirò, S. Di Franco, P. Fiorenza, R. Lo Nigro, F. Roccaforte, S. Ravesi, F. Giannazzo, *Interface Electrical Properties of Al<sub>2</sub>O<sub>3</sub> Thin Films on Graphene Obtained by Atomic Layer Deposition with an in Situ Seed-like Layer*, ACS Applied Materials & Interfaces 9, 7761-7771 (2017).
15. A. Piazza, F. Giannazzo, G. Buscarino, G. Fisichella, A. La Magna, F. Roccaforte, M. Cannas, F. M. Gelardi, B. Pignataro, M. Scopelliti, S. Agnello, *Substrate and atmosphere influence on oxygen p-doped graphene*, Carbon 107 (2016) 696-704.
16. F. Giannazzo, G. Fisichella, A. Piazza, S. Agnello, F. Roccaforte, *Nanoscale inhomogeneity of the Schottky barrier and resistivity in MoS<sub>2</sub> multilayers*, Phys. Rev. B 92, 081307(R) (2015).
17. Fisichella, G., Greco, G., Roccaforte, F., Giannazzo, F. *Current transport in graphene/AlGaN/GaN vertical heterostructures probed at nanoscale* (2014) Nanoscale, 6 (15), pp. 8671-8680.
18. *Microscopic mechanisms of graphene electrolytic delamination from metal substrates*, G. Fisichella, S. Di Franco, F. Roccaforte, S. Ravesi, F. Giannazzo, Appl. Phys. Lett. **104**, 233105 (2014).
19. Nicotra, G., Ramasse, Q.M., Deretzis, I., La Magna, A., Spinella, C., Giannazzo, F. *Delaminated graphene at silicon carbide facets: Atomic scale imaging and spectroscopy* (2013) ACS Nano, 7 (4), pp. 3045-3052.
20. Giannazzo, F., Deretzis, I., La Magna, A., Roccaforte, F., Yakimova, R. *Electronic transport at monolayer-bilayer junctions in epitaxial graphene on SiC* (2012) Physical Review B, 86 (23), art. no. 235422.

21. Giannazzo, F., Sonde, S., Lo Nigro, R., Rimini, E., Raineri, V. *Mapping the density of scattering centers limiting the electron mean free path in graphene* (2011) Nano Letters, 11 (11), pp. 4612-4618.

Data (Date), 17/02/2023

Firma (Signature)

A black rectangular redaction box covering the signature. Below the box, the handwritten signature "F. Giannazzo" is visible in blue ink.