# Curriculum Vitae

## INFORMAZIONI PERSONALI


**Nome** ROBERTO
**Cognome** MACALUSO
**Recapiti** Dipartimento di Ingegneria

**Telefono** 091-23860279
**E-mail** roberto.macaluso@unipa.it


## FORMAZIONE TITOLI

Sep 2003: **PhD Physics** - University of Strathclyde (Glasgow, UK).

**Title of the Thesis:** “GaInNAs 1.3 μm microcavity structures for advanced data communication devices”.

Mar 1999: **MSc Electronic Engineering** - University of Palermo (Palermo, Italy).

Final mark: 110/110 with honors (*summa cum laude*).

**Final Project:** “In situ monitoring of pulsed laser indium-tin-oxide (ITO) films deposition by optical emission spectroscopy”.

## ATTIVITA' DIDATTICA

- Nanoelectronics - graduate course (Master degree) in Electronics Engineering.
- Elettronica 2 - undergraduate course (Bachelor degree) in Electronics Engineering.
- Sensori e strumentazione biomedica - undergraduate course (Bachelor degree) in Biomedical Engineering.
- Promoter of more than 40 Bachelor and Master thesis since 2009.
- Member of the teaching board of the PhD course in Information and Communication Technologies (ICT).
- Supervisor of three PhD students.

## RICERCHE FINANZIATE

### Progetti attualmente finanziati:

• Da nov 2023: "Mid infrared metasurfaces and metamaterials for microplastic sensing applications". PRIN PNRR 2022. Codice progetto: PRJ-1110. Progetto in collaborazione con il CNR. Durata del progetto: 2 anni. Ruolo: Principal Investigator.
• Da set 2023: "C-MOOVO: Combined Molibdenum trioxide/Vanadium dioxide structures for a new class of tunable photonic devices in the mid-infrared". PRIN 2022. Codice progetto: PRJ-0885. Progetto in collaborazione con l’Università di Roma La Sapienza. Durata del progetto: 2 anni. Ruolo: Responsabile dell'Unità Locale (Università degli Studi di Palermo).
• Da ott. 2022: "Ecosistema dell’Innovazione Sicilian MicronanoTech Research And Innovation Center" (SAMOTHRACE). Fondi PNRR. Codice progetto: ECS00000022. Ruolo: Componente del gruppo di ricerca.
• Da giu. 2022: “Sustainable MAterials foR novel Thin film solar cells” (EUROSMART). MUR FONDI PNR D.M. 737/2021. Codice Progetto: PRJ-0997. Ruolo: Componente del gruppo di ricerca.
• Da dic. 2021: “Effetto della temperatura sul comportamento di memristor basati su HfO2”. Premio gruppi di ricerca 2021

finanziato dal Dipartimento di Ingegneria (FFR attribuito su quota premiale dal Dipartimento di Ingegneria in seguito alla valutazione di un progetto). Ruolo: Componente del gruppo di ricerca.
• Da ott. 2021: “METamateriali a cambiamento di fasE per telecOmunicazioni satellitari sicuRE” (METEORE). Piano Nazionale della Ricerca Militare (PNRM) 2020, progetto n. a2019.234. Progetto in collaborazione con l’Università di Padova e L’Università di Roma La Sapienza. Durata del progetto: 3 anni. Ruolo: Responsabile Scientifico dell’Unità Locale (Università degli Studi di Palermo).

**Progetti completati**

**Progetti europei:**
• 2016 - 2017: “Advancing Smart Optical Imaging and Sensing for Health” (ASTONISH) – H2020-ECSEL-2015-1-RIA Research and Innovation Actions”. GA N° 692470 - CUP B72F16001240001. Ruolo: Ricercatore.

**Progetti internazionali:**
• 2003 - 2006: MultiTeraNet "Schlüsselkomponenten für 40Gb/s Transceiver mit innovativen Realisierungskonzepten" (componenti chiave per transceiver con velocità di trasmissione 40Gb/s utilizzando concetti di realizzazione innovativi). Progetto finanziato dal Governo tedesco (01 BP 272). Ruolo: Post doct scholar.
• 2000 - 2003: “Physical layer High speed Optoelectronics for Tomorrow's Optical Networks” (PHOTON). Progetto finanziato dal Governo britannico, EPSRC (Engineering and Physical Sciences Research Council). Ruolo: PhD Student.

**Progetti PON:**
• 2012 - 2013: “Innovation for greeN Energy and eXchange in Transportation (i NEXT). Codice Progetto: PON04a2H. Ruolo: Ricercatore
• 2013: “Ambition Power”. Codice progetto: PON0100700. Ruolo: Ricercatore

**Progetti POR FESR Sicilia:**
• 2015: Rete integrata dei Laboratori Tecnologici delle Università Siciliane (RILTUS). Finanziamento: POR FESR Sicilia 2007-2013 asse IV, Obiettivo operativo 4.1.2, Linea di intervento 4.1.2.A. Ruolo: Ricercatore.

**Progetti di Ateneo (finanziali dall’Università degli Studi di Palermo):**
• 2012 - 2014: Crescita e caratterizzazione di interfacce metallo/ossido, metallo/polimero e metallo/ossido/polimero per applicazioni ingegneristiche. Codice progetto: 2012-ATE-0396. Ruolo: Ricercatore (microfabbricazione di dispositivi metallici/ ossidi/polimerici e loro caratterizzazione). - 2007: Utilizzo di un fascio polarizzato nel controllo dello spessore di strati dielettrici durante la crescita. Codice progetto: 2007-ATE-0317. Ruolo: Ricercatore.
• 2006: Crescita mediante laser e caratterizzazione di ossidi drogati per applicazioni fotoniche ed optoelettroniche. Codice progetto: 2006-ATE-0126.
Ruolo: Ricercatore.
• 2006: Fabbricazione e caratterizzazione di LED organici (OLED) con emissione nel blu per applicazioni ai biosensori. Ruolo: Ricercatore.

**ASSOCIAZIONI SCIENTIFICHE**

IEEE membership and IEEE Electron Devices Society membership.
Member of the "Associazione Società Italiana di Elettronica (SIE)".

**PUBBLICAZIONE**

## Journal papers

***1)*** M. C. Larciprete, D. Ceneda, C. Yang, S. Abedini Dereshgi, F. V. Lupo, M. P. Casaletto, ***R. Macaluso***, M. Antezza, Z. M. Zhang, M. Centini, and K. Aydin, Large-area polycrystalline -$MoO_3$ thin films for IR photonics, J. Phys. D: Appl. Phys. **57** 135107 (2024). DOI: https://doi.org/10.1088/1361-6463/ad18f6

***2)*** R. Li Voti, K. Agharahimli, M. Misano, M. C. Larciprete, G. Leahu, F. A. Bovino, C. Sibilia, T. Cesca, G. Mattei, F. V. Lupo, ***R. Macaluso***, Optothermal characterization of vanadium dioxide films by Infrared Thermography, International Journal of Thermal Sciences, **197**, 108832 (2024). DOI: 10.1016/j.ijthermalsci.2023.108832.

**3)** *B. Kalinic, T.* Cesca, A. Lovo, C. Scian, ***R. Macaluso***, F. Bovino, R. Li Voti, C. Sibilia, and G. Mattei, *Active Modulation of Er $^{3+}$ Emission Lifetime by $VO_2$ Phase-Change Thin Films. Advanced Photonics Research,* 2300242 (2023). *DOI: 10.1002/adpr. 202300242.*

**4)** M. C. Larciprete, D. Ceneda, D. Scirè, M. Mosca, D. Persano Adorno, S. A. Dereshgi, ***R. Macaluso***, R. Li Voti, C. Sibilia, T. Cesca, G. Mattei, K. Aydin, M. Centini, Tunable IR perfect absorbers enabled by tungsten doped $VO_2$ thin films, APL Materials, **11**, 091107 (2023). DOI: https://doi.org/10.1063/5.0164410

**5)** D. Trapani, ***R. Macaluso***, I. Crupi, M. Mosca, Color Conversion Light-Emitting Diodes Based on Carbon Dots: A Review, Materials, **15**, 5450 (2022). DOI: https://doi.org/10.3390/ma15155450.

**6)** D. Scirè, ***R. Macaluso***, M. Mosca, M. P. Casaletto, O. Isabella, M. Zeman, and I. Crupi, Density of states characterization of $TiO_2$ films deposited by Pulsed Laser Deposition for Heterojunction solar cells, Nano Research, **15**, 4048 4057 (2022). DOI: 10.1007/s12274-021-3985-8.

**7)** F. V. Lupo, D. Scirè, M. Mosca, I. Crupi, L. Razzari, and ***R. Macaluso***, Custom measurement system for memristor characterisation, Solid State Electronics, **186**, 108049 (2021). DOI: https://doi.org/10.1016/j.sse.2021.108049.

**8)** D. Scirè, ***R. Macaluso***, M. Mosca, S. Mirabella, A. Gulino, O Isabella, M. Zeman, and I. Crupi, Characterization of the defect density states in MoOx for c-Si solar cell applications, Solid State Electronics, **185**, 108135 (2021). DOI: https://doi.org/10.1016/j.sse.2021.108135

**9)** F. Yue, A. Aadhi, R. Piccoli, V. Aglieri, ***R. Macaluso***, A. Toma, R. Morandotti, and L. Razzari, Rotational Doppler Frequency Shift from Time-Evolving High-Order Pancharatnam–Berry Phase: A Metasurface Approach, Laser & Photonics Reviews, **15**, 2000576 (2021). *DOI:* http://dx.doi.org/10.1002/lpor.202000576

**10)** A. Boughelout, ***R. Macaluso***, I. Crupi, B. Megna, A. Brighet, M. Trari, M. Kechouane: "Effect of the Si doping on the properties of AZO/SiC/Si heterojunctions grown by low temperature pulsed laser deposition", Semiconductor Science and Technology, **36**, 015001 (2020). Doi: 10.1088/1361-6641/abbc42

***11) R. Macaluso,*** *G. Lullo, I. Crupi, D. Sciré, F. Caruso, E. Feltin and M. Mosca, Progress in Violet Light-Emitting Diodes Based on ZnO/GaN Heterojunction, Electronics,* ***9****, 991 (2020); doi:10.3390/electronics9060991*

***12)*** *A. Boughelout,* ***R. Macaluso****, M. Kechouane, M. Trari, Photocatalysis of rhodamine B and methyl orange degradation under solar light on ZnO and* $Cu_2O$ *thin films, Reaction Kinetics, Mechanisms and Catalysis,* ***129****, 1115 (2020).*

***13)*** *V. Aglieri, X. Jin, A. Rovere, R. Piccoli, D. Caraffini, S. Tuccio, F. De Angelis, R. Morandotti,* ***R. Macaluso****, A. Toma, L. Razzari, Improving nanoscale terahertz field localization by means of sharply tapered resonant nanoantennas, Nanophotonics,* ***9****, 683 (2020). DOI:* http://dx.doi.org/10.1515/nanoph-2019-0459

***14)*** F. Yue, V. Aglieri, R. Piccoli, ***R. Macaluso***, A. Toma, R. Morandotti, L. Razzari: "Highly sensitive polarization rotation measurement through a high-order vector beam generated by a metasurface", Adv. Mater. Technol., **1901008** (2020).

***15)*** T. Cesca, C. Scian, E. Petronijevic, G. Leahu, R. Li Voti, G. Cesarini, ***R. Macaluso***, M. Mosca, C. Sibilia, G. Mattei: "Correlation between in situ structural and optical characterization of the semiconductor-to-metal phase transition of $VO_2$ thin films on sapphire", Nanoscale, **12**, 851 (2020). DOI: http://dx.doi.org/10.1039/c9nr09024j

**16)** ***R. Macaluso***, G. Lullo, I. Crupi, F. Caruso, E. Feltin, M. Mosca, Current Spreading Length and Injection Efficiency in ZnO/GaN-Based Light-Emitting Diodes, IEEE Transactions on Electron Devices, **66**, Article number 8856269, Pages 4811-4816 (2019). DOI: http://dx.doi.org/10.1109/TED.2019.2942183

***17)*** V. Figà, H. Ustab, ***R. Macaluso***, U. Salznerd, M. Ozdemirb, B. Kulyke, O. Krupkaf, M. Bruno: "Electrochemical polymerization of ambipolar carbonyl-functionalized indenofluorene with memristive properties", Optical Materials, 94, 187 (2019).

**18)** A. Boughelout, ***R. Macaluso***, I. Crupi, B. Megna, M. S. Aida, and M. Kechouane: "Improved $Cu_2O$/AZO Heterojunction by Inserting a Thin ZnO Interlayer Grown by Pulsed Laser Deposition", Journal of Electronic Materials, 48, 4381 (2019).

***19)*** A. Boughelout, N. Zebbar, ***R. Macaluso***, Z. Zohour, A. Bensouilah, A. Zaffora, M.S. Aida, M. Kechouane, M. Trari:

"Rhodamine (B) photocatalysis under solar light on high crystalline ZnO films grown by home-made DC sputtering", Optik, **174**, 77 (2018).

**20)** A. Zaffora, ***R. Macaluso***, H. Habazaki, I. Valov, M. Santamaria: "Electrochemically prepared oxides for resistive switching devices", Electrochimica Acta, **274**, 103 (2018). DOI: http://dx.doi.org/10.1016/j.electacta.2018.04.087

***21)*** V. Aglieri, A. Zaffora, G. Lullo, M. Santamaria, F. Di Franco, U. Lo Cicero, M. Mosca, and ***R. Macaluso***: "Resistive switching in microscale anodic titanium dioxide-based memristors", Superlattices and Microstructures, Vol. **113**, 135 (2018). DOI: http://dx.doi.org/10.1016/j.spmi.2017.10.031

***22)*** *A. Zaffora, F. Di Franco, F. Di Quarto,* ***R. Macaluso****, M. Mosca,H. Habazaki, and M. Santamaria: "*The Effect of Nb Incorporation on the Electronic Properties of Anodic $HfO_2$", ECS Journal of Solid State Science and Technology, Vol. **6**, Issue 4, N25-N31 (2017).

**23)** M. Barbouche, R. B. Zaghouani, N. E. Benammar, V. Aglieri, M. Mosca, ***R. Macaluso***, K. Khirouni, H. Ezzaouia: "New process of silicon carbide purification intended for silicon passivation", Superlattices and Microstructures, **101**, 512 (2017).

**24)** F. Caruso, M. Mosca, S. Rinella, ***R. Macaluso***, C. Calì, F. Saiano, E. Feltin: "Frequency Down-Conversion Stability of PMMA Coatings in Hybrid White Light-Emitting Diodes", Journal of Electronic Materials, **45**, 682 (2016).

**25)** A. Sacco, M. S. Di Bella, M. Gerosa, A. Chiodoni, S. Bianco, M. Mosca, ***R. Macaluso***, C. Calì, C. F. Pirri: "Enhancement of photoconversion efficiency in dye-sensitized solar cells exploiting pulsed laser deposited niobium pentoxide blocking layers", Thin Solid Films, **574**, 38 (2015).

**26)** F. Di Franco, M. Santamaria, F. Di Quarto, ***R. Macaluso***, M. Mosca, and C. Calì: "Electrochemical Fabrication and Physicochemical Characterization of Metal/High-*k* Insulating Oxide/Polymer/Electrolyte Junctions", Journal of Physical Chemistry C, **118**, 29973 (2014).

**27)** ***R. Macaluso***, M. Mosca, V. Costanza, A. D'Angelo, G. Lullo, F. Caruso, C. Calì, F. Di Franco, M. Santamaria, and F. Di Quarto: "Resistive switching behaviour in ZnO and $VO_2$ memristors grown by pulsed laser deposition", Electronics Letters, **50**, 262 (2014). DOI: http://dx.doi.org/10.1049/el.2013.3175

**28)** M. Mosca, ***R. Macaluso***, G. Randazzo, M. Di Bella, F. Caruso, C. Calì, F. Di Franco, M. Santamaria, and F. Di Quarto: "Anodized Ti-Si Alloy as Gate Oxide of Electrochemically-Fabricated Organic Field-Effect Transistors, ECS Solid State Letters, **3**, 7 (2014).

**29)** M. Mosca, ***R. Macaluso***, C. Calì, R. Butté, S. Nicolay, E. Feltin, D. Martin, N. Grandjean: "Optical, structural, and morphological characterisation of epitaxial ZnO lms grown by pulsed-laser deposition", Thin Solid Films, **539**, 55 (2013).

**30)** ***R. Macaluso***, M. Mosca, C. Calì, F. Di Franco, M. Santamaria, F. Di Quarto, and J.-L. Reverchon: "Erroneous *p*-type assignment by Hall effect measurements in annealed ZnO films grown on InP", Journal of Applied Physics, **113**, 164508 (2013).

**31)** M. Mosca F. Caruso, L. Zambito, ***R. Macaluso***, C. Calì, and E. Feltin: "Hybrid LEDs pave way to new lighting applications, Photonics Spectra, **47**, 60 (2013).

**32)** F. Caruso, M. Mosca, ***R. Macaluso***, E. Feltin, and C. Calì: "Generation of white LED light by frequency downconversion using perylene-based dye", Electronics Letters, **48**, 1417 (2012).

**33)** P. G. Petrov, S. Machluf, S. Younis, ***R. Macaluso***, T. David, B. Hadad, Y. Japha, M. Keil, E. Joselevich, and R. Folman: "Trapping cold atoms using surface-grown carbon nanotubes"**,** Physical Review A, **79,** 043403 (2009).

**34)** B. K. Saravanan, T. Wenger, C. Hanke, P. Gerlach, M. Peschke and ***R. Macaluso*****:** "Wide temperature operation of 40-Gb/s 1550-nm electroabsorption modulated lasers", IEEE Photonics Technology Letters, 18, 862 (2006).

**35)** A.H. Clark, S. Calvez, N. Laurand, ***R. Macaluso***, H.D. Sun, M.D. Dawson, T. Jouhti, J. Kontinnen and M. Pessa: "Long-Wavelength Monolithic GaInNAs Vertical-Cavity Optical Amplifiers", IEEE Journal of Quantum Electronics, **40**, 878 (2004).

**36)** S. Calvez, J.-M. Hopkins, A. A. Smith, A.H. Clark, ***R. Macaluso***, H.D. Sun, M.D. Dawson, T. Jouhti and M. Pessa, K. Gundogdu, K. C. Hall and T. F. Boggess: "GaInNAs/GaAs Bragg-mirror-based structures for novel 1.3 mm device applications", Journal of Crystal Growth, **268**, 457 (2004).

**37)** ***R. Macaluso***, H. D. Sun, M. D. Dawson, F. Robert, A. C. Bryce, J. H. Marsh, and H. Riechert: "Selective modification of bandgap in GaInNAs/GaAs structures by quantum well intermixing", Applied Physics Letters, **82**, 4259 (2003).

**38)** ***R. Macaluso***, F. Robert, C. A. Bryce, S. Calvez, and M. D. Dawson: "Resonant wavelength control of a 1.3 mm microcavity by intracavity steam oxidation", Semiconductor Science and Technology, **18**, L12 (2003).

**39)** ***R. Macaluso***, F. Robert, C. A. Bryce, S. Calvez, and M. D. Dawson: "Microreflectivity studies of wavelength control in oxidised AlGaAs microcavity", Material Science Engineering B, **102**, 317 (2003).

**40)** H. D. Sun,***R. Macaluso***, S. Calvez, G. J. Valentine, D. Burns, M. D. Dawson, K. Gundogdu, K. C. Hall, T. F. Boggess, T. Jouthi, and M. Pessa: "Effects of rapid thermal annealing on the optical properties of low-loss 1.3 mm GaInNAs/GaAs saturable Bragg reflectors", Journal of Applied Physics, **96**, 1418 (2004).

**41)** H. D. Sun,***R. Macaluso***, M. D. Dawson, F. Robert, A. C. Bryce, J. H. Marsh and H. Riechert: "Characterization of selective quantum well intermixing in 1.3 mm GaInNAs/GaAs structures", Journal of Applied Physics, **94**, 1550 (2003).

**42)** H. D. Sun, ***R. Macaluso***, S. Calvez, M. D. Dawson, F. Robert, A. C. Bryce, J. H. Marsh, P. Gilet, L. Grenouillet, A. Million, K. B. Nam, J. Y. Lin and H. X. Jiang: "Quantum well intermixing in GaInNAs/GaAs structures", Journal of Applied Physics, **94**, 7581 (2003).

**43)** H. D. Sun, ***R. Macaluso***, S. Calvez, M. D. Dawson, F. Robert, A. C. Bryce, J. H. Marsh, H. Riechert, P. Gilet, L. Grenouillet and A. Million: "Selective modification of the band gaps of GaInNAs/GaAs structures by quantum well intermixing techniques", Materials Science Engineering C, **23**, 983 (2003).

**44)** S. Calvez, A.H. Clark, J.-M. Hopkins, ***R. Macaluso***, P. Merlin, H.D. Sun, M.D. Dawson, T. Jouhti and M. Pessa: "1.3 mm GaInNAs optically-pumped vertical cavity semiconductor optical amplifier", Electronics Letters, **39**, 100 (2003).

**45)** H. D. Sun, G. J. Valentine, ***R. Macaluso***, S. Calvez, D. Burns and M. D. Dawson: "Low-loss 1.3 μm GaInNAs saturable Bragg reflector for high-power picosecond neodymium lasers", Optics Letters, **27**, 2124 (2002).

**46)** C. Calì, ***R. Macaluso***, M. Mosca: "Effects of the process conditions on the plume of a laser-irradiated indium-tin-oxide target", Optics Communications, **197**, 341 (2002).

**47)** C. Calì, ***R. Macaluso***, M. Mosca: "In situ monitoring of pulsed laser indium-tin-oxide film deposition by optical emission spectroscopy", Spectrochimica Acta B, **56**, 743 (2001).

**Book Chapters:**

**1)** A. Zaffora, F. Di Franco, ***R. Macaluso***, M. Santamaria: "$TiO_2$ in memristors and resistive random access memory devices", Titanium Dioxide (TiO ) and its Applications, Elsevier, 2021, 507 – 526. https://doi.org/10.1016/B978-0-12-819960-2.00020-1

**2)** M. Mosca, ***R. Macaluso***, I. Crupi: "Hybrid Inorganic Organic White Light Emitting Diodes", Polymers for Light Emitting Devices and Displays, Wiley and Scrivener Publishing, 2020, 197-262 (ISBN: 978-1-119-65460-5).

**3)** M. Mosca, ***R. Macaluso***, F. Caruso, V. Lo Muzzo, C. Calì: "The p-Type Doping of ZnO: Mirage or Reality?", Advances in Semiconductor Research: Physics of Nanosystems, Spintronics and Technological Applications, Nova Science Publishers, New York, 2014 (ISBN: 978-1-63321-788-1).

**ATTIVITA' SCIENTIFICHE**

• Design, fabrication and characterisation of resistive memories (memristors, RRAMs) based on metal oxides (HfO2, TiO2, VO2, ZnO, Ta2O5 and organic materials).
• Pulsed laser deposition (PLD) and characterisation of semiconducting and insulating thin films (TiO2, VO2, MoO3, ZnO, Al:ZnO, Cu2O, SiC) and relevant heterostructures for Photonics and Optoelectronics devices.
• Fabrication and characterization of high efficiency white LEDs obtained by frequency down-conversion from blue LEDs through organic dyes.

**AMBITI DI RICERCA**

Nanoelectronics, Micro and Nano Technology, Photonics, Optoelectronics.