

## Section b: Curriculum vitae (max. 2 pages)

### Personal Information

Family name: La Via

First name: Francesco

Researcher unique identifier: ORCID ID [orcid.org/0000-0002-6842-581X](https://orcid.org/0000-0002-6842-581X), [ResearcherID E-8035-2011](#), [Scopus Author ID 7006003283](#),

Nationality: Italian

Date of birth: 23<sup>rd</sup> September 1961

### • Education and fellowships

Nov 1990 – Jul 1991 - Fellowship at Philips Nat Lab Eindhoven (Nederland)

Oct 1989 – Sep 1991 – Fellowship at CNR-IMM, Catania (Italy)

Apr 1986 – Oct 1989 – Fellowship at STMicroelectronics, Catania (Italy)

Dec 1985 – Master in Physics, Catania University, Italy

### • Current position and institutional responsibilities

2016 – today – Member of the CNR-IMM Institute Council

2006 – today – Head of the Department on SiC growth and new applications

Dec 2001 – today Senior Researcher at CNR-IMM, Catania, Italy

### • Previous positions

Mar 1998 – Dec 2001 Researcher at CNR-IMM, Catania, Italy

Sep 1991 – Mar 1998 Researcher contract at CNR-IMM, Catania, Italy

### • Supervision of graduate students and postdoctoral fellows

2006-2016 6 Postdocs at CNR-IMM, Catania, Italy

2007 - 2008 1 Master student Tampa University, Florida, USA

1987 -2018 22 Master students, 7 PhD Students, of Catania University

### • Teaching activities

- Jul 2008 – Sep 2009 – Course on the *Formation of experts in high band-gap semiconductors growth*, CNR-IMM, Italy

- 2008 Physics of Advanced Materials Winter School (PAM1), Thessaloniki, Greece

- 2012 – Tutorial on the *Growth of SiC – from bulk to thin layer*, ECSCRM 2012, Saint Petersburg, RUSSIA

- 2018 Tutorial on Silicon Carbide Bulk and Epitaxy Material: a comparison between 3C-SiC and 4H-SiC, ECSCRM 2018, Birmingham, UK.

### • Main Research Projects

2017-2020 *WInSiC4AP - Wide band gap Innovative SiC for Advanced Power* – ECSEL Project – CNR-IMM coordinator (material)

2017-2021 “3C-SiC Hetero-epitaxiALLY grown on silicon compliance substrates and new 3C-SiC substrates for sustainaBle wide-band-Gap powEr devices (CHALLENGE)” – H2020 Project – Project coordinator

2012-2016 “*Hi-Quad: sustainable quadricycle*” – Italian Project of Ministry of Industrial Development – CNR-IMM coordinator.

2012-2015 “*New photovoltaic technology for smart systems integrated in buildings*” - Italian Project of Ministry of Research – CNR-IMM coordinator

2006-2014 “*Public/private laboratory for the realization of new reactors and new processes for the SiC wafer production*” – Italian Project of Ministry of Research -CNR-IMM coordinator

2002-2005 “*Project and realization of an homo-epitaxial process of SiC*” – Italian Project of Ministry of Research – CNR-IMM coordinator

2000-2004 “*Scientific Research, Technological Development and High Level Formation*” – Italian Project of the Ministry of Research – Project coordinator.

1996-2000 “*Materials, processes and devices for sensors, opto-electronics and power electronics*” – Italian Project of the Ministry of Research – CNR-IMM coordinator

- **Main industrial projects**

2015-2016 Contract for the development of new processes for SiC and GaN power devices – STMicroelectronics (Italy) – CNR-IMM coordinator

2013-2014 *Contract for structural and morphology characterization of SiC/Si hetero-epitaxy grown on pillars* – Epitaxial Technology Centre (Italy) – CNR-IMM coordinator

2012-2013 *Contract for the characterization of epitaxial process and for the reduction of defects coming from the substrates* – Epitaxial technology Centre (Italy) – CNR-IMM coordinator

2011-2012 *Contract for the development of SiC Homo-epitaxy and epitaxial layer characterization* – Bridgestone (Japan) – CNR-IMM coordinator

2010-2011 *Contract for the development of hetero-epitaxial processes Si/3C-SiC/Si for MOSFET realization* – STMicroelectronics (Italy) – CNR-IMM coordinator

- **Summary of publications and invited presentations**

336 Papers in international peer review journals

3 Edited books

3 Chapters

12 Invited presentations

- **Major collaborations**

2013 – today Prof. L. Miglio (Milano University (Italy)) and Prof. H. von Kanel (ETH (Suisse)) – 3D Hetero-epitaxy of 3C-SiC/Si

2006 – today Prof. S.E. Saddow (University of South Florida (USA)) - 3C-SiC growth and study of mechanical properties

2000 – today Epitaxial Technology Centre – SiC homo-epitaxy and hetero-epitaxy, epitaxial layers characterizations, CVD reactors simulation

1985 – today STMicroelectronics – Silicon metallization, SiC Schottky diodes, SiC MOSFET, 4H-SiC homo-epitaxy, 3C-SiC hetero-epitaxy, epitaxial layers characterizations

- **Ground breaking research and creative independent thinking**

2004 – today *Development of a new silicon carbide epitaxial process with chloride precursors and high growth rate* – This research has opened a new field in the epitaxy of silicon carbide, improving the throughput of the reactors and showing that several defects (stacking faults, step bunching, dislocations, ...) can be reduced thanks to this high growth rate processes. When this process was presented at the ECSCRM 2004 from the PI no other similar processes have been presented before.

2009 – today *Development of compliance substrates for hetero-epitaxial growth of 3C-SiC/Si* – This research has opened a new field in the hetero-epitaxial growth of 3C-SiC/Si, showing that with an optimization of the compliance substrates it is possible to reduce both the defects density and the strain. When this approach was presented, it was the first time that the reduction of these two important parameters has been obtained at the same time.

- **Achievements beyond the state of the art**

When the process at 100  $\mu\text{m}/\text{h}$  was presented for the first time at the ICSCRM 2005 in Pittsburgh was a great improvement with respect the usual SiC epitaxial processes where a typical growth rate was 4-6  $\mu\text{m}/\text{h}$ . Even today this process is better than the usual process utilized in the industries of SiC power devices.

In 2006 at the MRS Spring Meeting in Phoenix a new high growth rate process with a low stacking faults density was presented. With this process a reduction of two orders of magnitude in the SF density has been achieved with respect to the typical processes reported in literature.

**Section c: Ten years track-record (max. 2 pages)**

- 1) La Via, F.; Izzo, G.; Mauceri, M.; Pistone, G.; Condorelli, G.; Perdicaro, L.; Abbondanza, G.; Calcagno, L.; Foti, G.; Crippa, D., JOURNAL OF CRYSTAL GROWTH, 311, 107-113 (2008) (cit. 61)
- 2) Severino A.; Bongiorno, C.; Piluso, N.; Italia, M.; Camarda, M.; Mauceri, M.; Condorelli, G.; Di Stefano, M. A.; Cafra, B.; La Magna, A.; La Via, F., THIN SOLID FILMS, 518, S165-S169 (2010) (cit. 51)
- 3) Anzalone, R.; Severino, A.; D'Arrigo, G.; Bongiorno, C.; Abbondanza, G.; Foti, G.; Sadow, S.; La Via, F., JOURNAL OF APPLIED PHYSICS, 105, 84910 (2009) (cit. 43)
- 4) Severino, A.; Frewin, C.; Bongiorno, C.; Anzalone, R.; Sadow, S. E.; La Via, F., DIAMOND AND RELATED MATERIALS, 18, 1440-1449 (2009) (cit. 44)
- 5) Anzalone, R.; D'Arrigo, G.; Camarda, M.; Locke, C.; Sadow, S. E.; La Via, F., JOURNAL OF MICROELECTROMECHANICAL SYSTEMS, 20, 745-752 (2011) (cit. 39)
- 6) M Cutroneo, P Musumeci, M Zimbone, L Torrisi, F La Via, D Margarone, A Velyhan, J Ullschmied, L Calcagno, Journal of Materials Research, 28, 87-93 (2013) (Cit. (43)
- 7) F. La Via, M. Camarda, A. La Magna, Applied Physics Reviews, 1, 031301 (2014) (cit. 36)
- 8) R Anzalone, M Camarda, A Canino, N Piluso, F La Via, G D'arrigo, Electrochemical and Solid-State Letters, 14, H161-H162 (2011) (Cit. 30)
- 9) M Camarda, A La Magna, P Fiorenza, F Giannazzo, F La Via, Journal of Crystal Growth, 310, 971-975 (2011) (Cit. 30)
- 10) Severino, A Camarda, M Condorelli, G Perdicaro, LMS Anzalone, R Mauceri, M La Magna, A ; La Via, F, APPLIED PHYSICS LETTERS, 94, 101907 (2009) (Cit. 25)

**• Research monographs**

- 1) F. La Via, S.E. Sadow, D. Alquier, J. Wang, M. Fraga, "SiC based Miniaturized Devices", in press (2019).
- 2) F. La Via, F. Roccaforte, F. Giannazzo, R. Nipoti, M. Saggio, "Silicon Carbide and Related materials 2015" (TransTech Publications, ISBN 978-3-0357-1042-7) (2016)
- 3) S.E. Sadow, F. La Via, "Silicon carbide Devices", (Intech Editor, ISSN/ISBN 978-953-51-4347-5) (2015)
- 4) S.E. Sadow, Y. Koshka, F. La Via, E. Sanchez, H. Tsuchida, F. Zhao, "Journal of Material Research: Focus Issue Silicon Carbide - Materials, Processing and devices", (Materials Research Society - Cambridge University Press Editor, ISSN/ISBN 0884-2914) (2013)
- 5) F. La Via, "Silicon Carbide Epitaxy", (Research Signpost Editor, ISSN/ISBN 978-81-308-0500-9) (2012)

**• Granted patents**

- 1) Roccaforte F., Raineri V., La Via F., Saggio M., "Process for manufacturing a schottky contact on a semiconductor substrate", UNITED STATES PATENT, US 20060183267 A1 (2006)
- 2) Roccaforte F., Raineri V., La Via F., Saggio M., "Process for manufacturing a schottky contact on a semiconductor substrate", EUROPEAN PATENT, EP 1641029 A1 (2006)
- 3) G.A.M. D'Arrigo, F. La Via, "Semiconductor substrate suitable for the realisation of electronic and/or optoelectronic devices and relative manufacturing process", EUROPEAN PATENT EP 2122668 A2 (2009); UNITED STATES PATENT US 20100013057 A1 (2010)
- 4) M. Camarda, A. Severino, F. La Via, "Manufacturing of wafers of wide energy gap semiconductor material for the integration of electronic and/or optical and/or optoelectronic devices", EUROPEAN PATENT EP 2737521 A1 (2012); UNITED STATES PATENT US 20140264385 A1 (2014)

**• Invited presentations to peer-reviewed internationally established conferences and/or international advanced schools**

- 1) F. La Via, "Advanced characterization of 3C-SiC epitaxial layer by TEM and XRD pole figure", Physics of advanced materials winter schools, Tessaoniki, Grece 2008.
- 2) M. Camarda, A. Canino, A. La Magna, F. La Via, "Evolution of Stacking Faults Defects During Epitaxial Growths: Role of Surface Kinetics", MRS Spring Meeting 2010 Symposium B: Silicon Carbide - Materials, Processing, and Devices.
- 3) M. Camarda, A. Canino, A. La Magna, F. La Via, "Evolution of Stacking Faults Defects During Epitaxial Growths: Role of Surface Kinetics", European Conference for Silicon Carbide and Related Materials 2010.
- 4) F. La Via, R. Anzalone, M. Camarda, N. Piluso, A. Severino, "Large Area Hetero-Epitaxial Growth of 3C-Si on Si", E-MRS 2011 "Engineering of wide band gap semiconductor materials for energy savings".

- 5) A. Severino, C. Locke, F. La Via, S.E. Saddow, "High Quality Cubic Silicon Carbide (3C-SiC) for MOS applications", 220th ECS Meeting' Boston, 9-14 Ottobre 2011
- 6) A. Severino, M. Mauceri, R. Anzalone, A. Canino, N. Piluso, C. Vecchio, M. Camarda, F. La Via, "Growth and Processing of heteroepitaxial 3C-SiC films for electronic device applications", MRS Spring Meeting 2012 Symposium H: Silicon Carbide–Materials, Processing, and Devices.
- 7) F. La Via, M. Camarda, A. Canino, A. La Magna, "Fast growth rate epitaxy by chloride precursors", European Conference for Silicon Carbide and Related Materials 2012.
- 8) F. La Via, "High growth rate epitaxy of SiC", Tutorial Day of ECSCRM 2012.
- 9) F. La Via, M. Camarda, A. Canino, A. Severino, A. La Magna, M. Mauceri, C. Vecchio, D. Crippa, "Fast growth rate epitaxy by chloride precursors", Collaborative Conference on Crystal Growth (3CG 2013).
- 10) F. La Via, S. Privitera, G. Litrico, L. Calcagno, F. Capuzzello, S. Tudisco, T. Agodi, "Challenges of SiC technology for high radiation hardness detectors", NUMEN Workshop 2015.
- 11) F. La Via, M. Camarda, et al. "Growth of SiC on Si: challenges, experiments and simulations" in the "Material and Device Integration on Silicon for Advanced Applications" symposium of EMRS Fall 2017.
- 12) F. La Via et al. "Reduction of 2D and 3D defects in 3C-SiC" EMRS Spring Meeting 2018, Symposium "Materials research for group IV semiconductors: growth, characterization and technological developments III"

- **Organization of international Conferences in the field of the applicant (membership in the steering and/or organising committee)**

- 1) ECSCRM 2008, Participation to the Technical Program Committee
- 2) ECSCRM 2010, Participation to the Technical Program Committee
- 3) "Wide band gap cubic semiconductors: from growth to devices" E-MRS 2010 spring meeting, Participation to the Technical Program Committee
- 4) ICSCRM 2013, Chair of the Steering Committee
- 5) ICSCRM 2015, Chair of the Steering Committee, Co-chair of the Conference, Chair of the Technical Program Committee
- 6) ECSCRM 2016, Participation to the Technical Program Committee, participation to the ICSCRM Steering Committee
- 7) ICSCRM2017 – Washington, USA – Participation to the Technical Program Committee, participation to the ICSCRM Steering Committee.
- 8) ECSCRM2018 – Birmingham, UK – Participation to the Technical Program Committee, participation to the ICSCRM Steering Committee.
- 9) E-MRS Spring Meeting 2019 – Nizza F – Symposium X - Silicon carbide and related materials for energy saving applications – Conference Chair

- **Major contributions to the early careers of excellent researchers**

Researchers	Current research organization/activity	PhD year	N. of publications	h-index	Research page
Massimo Camarda	Paul Scherrer Institute/SiC MOSFET processing	2006	113	17	<a href="https://scholar.google.it/citations?user=dtXYWgMAAAAJ&amp;hl=it">https://scholar.google.it/citations?user=dtXYWgMAAAAJ&amp;hl=it</a>
Andrea Severino	STMicroelectronics/ SiC and GaN epitaxy	2006	91	13	<a href="https://scholar.google.it/citations?user=fBFsmlwAAAAJ&amp;hl=it">https://scholar.google.it/citations?user=fBFsmlwAAAAJ&amp;hl=it</a>
Nicolò Piluso	STMicroelectronics/ SiC wafers characterization	2008	87	10	<a href="https://scholar.google.it/citations?user=-eqTSW4AAAAJ&amp;hl=it">https://scholar.google.it/citations?user=-eqTSW4AAAAJ&amp;hl=it</a>
Ruggero Anzalone	STMicroelectronics/ SiC epitaxy and hetero-epitaxy	2009	81	12	<a href="https://scholar.google.it/citations?user=zbRSqf8AAAAJ&amp;hl=it">https://scholar.google.it/citations?user=zbRSqf8AAAAJ&amp;hl=it</a>
Alessandra Alberti	CNR-IMM/ solar cells and XRD characterization	2000	117	17	<a href="https://scholar.google.it/citations?user=7GTrh0gAAAAJ&amp;hl=it">https://scholar.google.it/citations?user=7GTrh0gAAAAJ&amp;hl=it</a>
Stefania Privitera	CNR-IMM/ solar cells characterization	2001	82	17	<a href="https://scholar.google.it/citations?user=kaWYTHQAAAAJ&amp;hl=it">https://scholar.google.it/citations?user=kaWYTHQAAAAJ&amp;hl=it</a>

Andrea Canino	3SUN/solar cells	2008	48	9	<a href="https://scholar.google.it/citations?user=DuWdpMQAAAAJ&amp;hl=it">https://scholar.google.it/citations?user=DuWdpMQAAAAJ&amp;hl=it</a>
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