

# Vanni Lughi

Department of Engineering and Architecture – University of Trieste, Italy

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## Academic Education

April 2<sup>nd</sup>, 2001 – June 16<sup>th</sup>, 2006

**Ph.D. in Materials** - Materials Department, University of California at Santa Barbara (USA)

Aluminum Nitride Thin Films for MEMS resonators: Growth and Characterization (Advisor: David R. Clarke)

April 2<sup>nd</sup>, 2001 – December 12<sup>th</sup>, 2005

**M.S. in Materials** - Materials Department, University of California at Santa Barbara (USA)

Phase Stability of Yttria-Stabilized Zirconia for Thermal Barrier Coating Applications (Advisor: David R. Clarke)

September 1993 – December 15<sup>th</sup>, 1999

**“Laurea” in Materials Engineering** (5-year program and research thesis) – *Materials Dept., University of Trieste, Italy*

Microstructural and mechanical properties of Si<sub>3</sub>N<sub>4</sub> cutting tools studied by Raman spectroscopy (Advisor: Valter Sergo)

## Academic Professional Experience

December 17<sup>th</sup>, 2019 – to date

**Associate Professor** - Department of Engineering and Architecture, University of Trieste and **Head**, naME Lab - nanoMaterials & Energy Lab (November 2008 – to date)

- Nanostructured materials; Photovoltaics and solar energy; Properties of ceramic materials.

November 1<sup>st</sup>, 2008 – December 16<sup>th</sup>, 2019

**Assistant Professor** - Department of Engineering and Architecture, University of Trieste

July 2<sup>nd</sup> – July 31<sup>st</sup>, 2017

**Visiting researcher** – Electrical and Computing Engineering Department, University of California at Santa Barbara

- Thin films for photonics applications (prof. Jonathan Klamkin's group)

December 12<sup>th</sup>, 2006 – October 31<sup>st</sup>, 2008

**Post-Doctoral Researcher** – Department of Materials and of Natural Resources, University of Trieste (Italy) under the “Talents Friuli-Venezia Giulia” fellowship program (Area Science Park, Trieste, Italy)

- Development of novel, nanostructured photovoltaic materials synthesized through colloidal chemistry routes

June 17<sup>th</sup>, 2006 – November 20<sup>th</sup>, 2006

**Post-Doctoral Researcher** – Materials Department, University of California at Santa Barbara

- Design and implementation of diffusion experiments in zirconium oxide
- Mentoring of graduate students and interns
- Design of Raman and photoluminescence experiments (piezospectroscopy, phase identification, etc.)

## Academic Appointments and Service

November 2009 – to date

**Faculty member, Ph.D. School on Nanotechnology**, University of Trieste, Italy

March 2014 – January 2020

**Deputy Director for Community Affairs and Business Relations**, Dept. Engineering and Architecture

May 2019 – to date

**Member, Technical and Scientific Committee for Electron Microscopy**, University of Trieste

April 2019 – September 2019

**Member, 2021-2027 National Strategic Research Plan Drafting Team** for the Italian Ministry for Research - Workgroup on Green Technologies

May 2016 – to date

**Member, Technical and Scientific Committee LAMA FVG** – Laboratory for Advanced Mechatronics and 3D printing

June 2016 – to date

## Member, Scientific Committee

**Collegio Universitario di Merito "L. Fonda"** – University of Trieste (college reserved to high-performing students)

June 2013 – to date

**Director, Annual Summer School on Energy "Giacomo Ciamician"**

October 2010 – December 2015

**Master in Complex Actions, SISSA** – International Superior School on Advanced Studies, Trieste (top graduate student-only university)

- Teaching program director; lecturer

**Peer reviewing:** *Acta Materialia*, *Applied Physics Letters*, *Journal of the American Ceramic Society*, *Journal of Applied Physics*, *Surface and Coating Technology*, *Journal of Alloys and Compounds*, *Journal of the European Ceramic Society*, *Ceramics International*, *Journal of Nanoparticle Research*

## Industrial Research Experience

July 2008 – September 2012

**R&D Manager and CTO** – MaXun Ltd, Trieste, Italy (high-tech startup)

- Novel photovoltaic solar cell materials based on quantum dots and nanostructured materials

July 2007 – October 2008

**Senior R&D Engineer** – Genefinity srl, Trieste, Italy (high-tech startup)

- Thin Film Deposition and Characterization on polymer substrates; development of a novel industrial roll-to-roll process for one-step deposition of patterned thin films, for biosensing and RFID applications.

November 1998 – February 1999

**Associate Researcher** – Research and Development Division, CeramTec AG, Plochingen, Germany

- Characterization and applications of Silicon Nitride ceramics

## Entrepreneurship and Management

July 2008 – September 2012

**Co-founder and member of the board of directors (CTO)** – MaXun Ltd., Italy

April 2008 – to date

**Partner** – Genefinity Ltd., Italy

## Academic Teaching and Mentoring

November 2008 – to date

*Faculty member, College of Engineering – University of Trieste, Italy*

November 2009 – to date

*Faculty member, Ph.D. School on Nanotechnology – University of Trieste, Italy*

January 2010 – to date

Department of Engineering and Architecture, University of Trieste

**Supervisor** of 4 PhD students, 8 postdoctoral researchers

May 2007 – to date

Department of Engineering and Architecture, University of Trieste

**Final Thesis advisor** of over 30 MS Students and 40 BS Students

### Academic Lecturing:

September 2011 – to date

University of Trieste

**Instructor** – Materials and Process Design (9 credit course, MS Degree in Materials and Process Engineering)

February 2010 – to date

University of Trieste

**Instructor** – Nanostructured materials (4 credit course, MS Degree in Materials and Process Engineering)

February 2015 – to date

University of Trieste

**Co-Instructor** – Science and Technology of Materials (9 credit course, BS Degree in Industrial Engineering)

February 2007 – to date

University of Trieste

**Co-Instructor** – Electric and Photovoltaic Materials (3 credit course, MS Degree in Materials and Process Engineering)

### Other teaching and mentoring:

January 2011 – December 2015

SISSA – International School on Advanced Studies

**Instructor and mentor** – Business modeling for hi-tech startups

June 2010 – to date

Summer School on Energy "Giacomo Ciamician"

**Instructor** – Energy as a global challenge; Energy Supply Chain; Physics of Photovoltaics

## Professional Qualifications

- June 2000

**Certification of the National Board of Engineers**, Italy, for the practice of the profession

## Honors and Awards

- **Top downloaded paper 2018-2019, J. American Ceramic Society** - Chevalier J et al., "Fourty years after the promise of «ceramic steel?»: zirconia-based composites with a metal-like mechanical behavior", J Am Ceram Soc 103, 1482-1513 (2020)
- **Best Poster Award** – Cibinel M et al., "Recycling of polyanion based thermal insulator composite", Polymer Connect, International Conference on Polymer Science and Composite Materials, Lisbon, 2020
- **National Innovation Prize 2008** – Team member. The project ranked 2<sup>nd</sup> at the national level
- **National Innovation Prize 2007** – Team leader. The project ranked 1<sup>st</sup> in the category "Energy", and 5<sup>th</sup> overall
- December 2006 – November 2008  
**"Talents Friuli–Venezia Giulia" Fellowship** – Area Science Park, Trieste (Italy). The Fellowship was granted for conducting research on Renewable Energy at the Materials Department, University of Trieste (Italy).
- September 2006  
**Global School for Advanced Studies (GSAS)** – National Tsing Hua University, Hsinchu (Taiwan), and Academia Sinica (Taiwan). Selected scholar for the GSAS session on Advanced Solar Cells Research. Scholarship of the US National Science Foundation.
- June 2005  
**Summer Institute on NanoMechanics and Materials** - Northwestern University, IL (USA). Summer school on Nanotechnology, Biotechnology, and Green Manufacturing for Creating Sustainable Technologies. Scholarship of the US National Science Foundation.
- 1994-1997  
**ERDISU Fellowship** – Fellowship for outstanding students of the Regional Institute for the Right of Study, University of Trieste, Italy. Four times recipient (1994-1997).

## Invited Talks and Lectures

- **Invited Plenary Talk:** "Nanoparticles and Nanostructured Materials for Energy Applications", 36th SPP Physics Conference, Puerto Princesa, The Philippines. June 6th, 2018
- **Invited Plenary Talk:** "Solar Energy Outlook and the Impact of Greenhouse Gas Emissions", ATMOS 2017, 8th Atmospheric Sciences Symposium, Istanbul, Turkey. November 1st, 2017
- **Invited Opening lecture:** "Towards the perfect storm". CEI High Level Workshop: Building on the Virtual WB Regional Center for Hydrometeorological Services and Climate Change, Skopje (Republic of Macedonia), September 2015
- "Engineering (with) Nanoparticles: Energy applications and more". Advanced workshop in solar energy conversion and nanophysics, Bucharest. September 2015
- "Nanotechnology for Photovoltaics". Advanced workshop in solar energy conversion and nanophysics, Bucharest. September 2014
- **Invited Opening Lecture:** "Energy as a global issue". Geothermal Energy ECSAC Workshop, Veli Losinj (HR), August 2014
- "Nanotechnology for Renewable Energy". International Conf. on Nanoelectronics, Communications and Renewable Energy, Sept. 22-23, 2013 - Jijel, Algeria
- "Hybrid metal-semiconductor nanomaterials for energy and bioapplications". Nano-Bio-Med 2013, October 2013
- "New approaches to photovoltaic technologies". Seminar at Elettra Sincrotron, Trieste. July 2013
- "Photovoltaic Technologies". International Workshop AMASING, Technical University Dresden. June 2012
- "Nanotechnology for Photovoltaics". Advanced Worskhop on Solar Energy Conversion, Bucharest. May 2012
- "Nanotechnology for Photovoltaics". Worskhop on new materials for renewable energy, ICTP Trieste. October 2011
- "Engineering (through) Nanocrystals". NREL National Renewable Energy Laboratory, Golden, CO, USA – March 2011
- "Nanotechnology in Photovoltaics". ECSAC10 – Sustainable Energy Conference, Veli Losinj, Croatia. August 2010
- "Bio- and Nanomaterials in Photovoltaics". CBM – Biomed Cluster, Area Science Park Trieste, Italy. March 2009
- "Approcci chimici alla fabbricazione di materiali fotovoltaici nanostrutturati". I giovani e la chimica. Dipartimento di Scienze della Vita, Universtà di Trieste, Italy. September 2009.

## Public Funding

### Current

- 2019-2021 Principal Investigator of the UniTrieste Research Unit
- Program: EU - Interreg Italia – Croatia. Project: "DeepSea - Energy Efficiency for the Mobility of Adriatic Marinas". Directly managed funding (approx.): € 250,000

- 2017-2020 Principal Investigator (of the overall project)
- Program: EU - Interreg Italia – Slovenia. Project: "MUSE - Cross-border collaboration for a Sustainable and Energy Efficient Mobility". Directly managed funding (approx.): € 1,450,000

## Past

- 2017-2019 Project partner
- Program: POR-FESR 2014-2020 program. Project "GGTDoors". Topic: "Cradle-to-cradle" nanostructured composites for thermally insulating doors". Directly managed funding (approx.): €50,000
- 2014-2015 Principal Investigator
- Program: FRA (Internal University Fund for Research). Project: "An integrated microgrid for the university campus". Directly managed funding (approx.): €11,000
- 2014 Principal Investigator
- Program: PoCN (Proof of Concept Network) Program. Project: "Hybrid Nanoparticles as Optical Markers". Directly managed funding (approx.): € 15,000
- 2012-2013 Project partner
- Program: POR-FESR 2007-2013. Project: "Greenboat" - Design and realization of a boat with low environmental impact through via use of appropriate energy and materials technology". Topics: sustainable materials; photovoltaic solutions. Directly managed funding (approx.): € 34,000
- 2009-2013 PI at UniTrieste Research Unit
- Program: EU-7th Framework Program - IRSES Scheme. Project: "Development of Flexible single and tandem II-VI-Based High Efficiency Thin Film Solar Cells". Directly managed funding (approx.): € 43,000
- 2008-2011 Principal Investigator
- Program: FVG Regional research program (LR17/09). Project: "NanoPV" - Development of a new nanostructured photovoltaic material". Directly managed funding (approx.): €50,000

## Industry collaborations, research projects and consulting (selected contracts)

Ily; Siemens; Wartsila; Coveme; Doceram; EPS Italia; Automotive Lighting Italia, Magneti Marelli; Idea Prototipi; SMS Meer; Labor Security Systems; Friulana Costruzioni; Fototherm; Keratech; Copernico.

Legal expert consulting, Expert witness.

## Science Communication and Public Engagement (selected)

- Co-author and narrator – TV science show "Memex: Galileo". 8 episodes on nanotechnology, repeatedly aired on RAI (Italian National Public TV) since March 2018
- Over 10 TV and radio interviews on nanotechnology and sustainable energy
- Over 30 invited talks and lectures for the general public
- Moderator at 5 events on topics involving nanotechnology, energy and sustainability
- Author (with A. Massi Pavan): "La forza del sole", an article for the general public on "Sapere" magazine, one of the main science communication magazines in Italy

## Publications

**Peer reviewer journal papers** citations: 1474; citations excluding self-citations from all authors: 1292; h-index: 19 (Scopus, September 2020)

44. Cibinel M, Pugliese G, Porrelli D, Marsich L, Lughì V, "A new recycling method for alginate thermal insulation composites", Carbohydrate Polymers (accepted)

**43. Fermeglia M, Lughì V, Massi Pavan A, "How to avoid the perfect storm: the role of energy and photovoltaics", MRS Energy & Sustainability (accepted)**

42. Lughì V, Lenaz D, Bonifacio A, Princivalle F, Sergio V, Parisi F, "A Raman spectroscopy study of the oxidation processes in synthetic chromite FeCr<sub>2</sub>O<sub>4</sub>", Ceramics International (accepted)

**41. Slejko EA and Lughì V, "Engineering of colloidal nanocrystal thin films and their optoelectronic properties: a simple and effective route", Nano-Structures & Nano-Objects 22, 100432 (2020)**

40. **Invited featured article:** Chevalier J, Liens A, Reveron H, Zhang F, Reynaud P, Douillard T, Preiss L, Sergio V, Lughì V, Swain M, Courtois N, "Forty years after the promise of «ceramic steel?»: zirconia-based composites with a metal-like mechanical behavior", Journal of the American Ceramic Society 103 (3), 1482-1513 (2020)

39. M Scorrano, R Danielis, S Pastore, V Lughì, A Massi Pavan, "Modeling the Total Cost of Ownership of an Electric Car Using a Residential Photovoltaic Generator and a Battery Storage Unit—An Italian Case Study", Energies 13 (10), 2584 (2020)

38. MM Vega, A Bonifacio, V Lughì, V Sergio, "Fine Determination of Monoclinic Phase in Zirconia-Based Implants: A Surface-Enhanced Raman Spectroscopy (SERS) Study", Journal of nanoscience and nanotechnology 20 (4), 2430-2435 (2020)

37. A Liens, H Reveron, T Douillard, N Blanchard, V Lughì, V Sergio, R Laquai, et al. "Phase transformation induces plasticity with negligible damage in ceria-stabilized zirconia-based ceramics", Acta Materialia 183, 261-273 (2020)

36. S Boulhidja, A Mellit, S Voswinckel, V Lughì, A Ciocia, F Spertino et al., "Experimental evidence of PID effect on CIGS photovoltaic modules" Energies 13 (3), 5371 (2020)

35. Milocco A, Scuor N, Lughì V, Lamberti G, Barba AA, Divittorio R, Grassi G, Perkan A, Grassi M, Abrami A, "Thermal gelation modelling of a pluronic-alginate blend following coronary angioplasty", *Journal of Applied Polymer Science* 137 (25), 48539 (2020)
34. A Mellit, A Massi Pavan, E Ogliaeri, S Leva, V Lughì, "Advanced Methods for Photovoltaic Output Power Forecasting: A Review", *Applied Sciences* 10 (2), 487 (2020)
33. D Lenaz, V Lughì, D Perugini, M Petrelli, G Turco, B Schmitz, "MgAl<sub>2</sub>O<sub>4</sub> spinels from Allende and NWA 763 carbonaceous chondrites: Structural refinement, cooling history, and trace element contents", *Meteoritics & Planetary Science* 54 (12), 3089-3100 (2019)
32. Nespoli A, Ogliaeri E, Leva S, Massi Pavan A, Mellit A, Lughì V, Dolara A, "Day-ahead photovoltaic forecasting: A comparison of the most effective techniques", *Energies* 12 (9), 1621 (2019)
- 31. Slejko EA, Lughì V, "Size Control at Maximum Yield and Growth Kinetics of Colloidal II–VI Semiconductor Nanocrystals", *Journal of Physical Chemistry C* 123 (2), 1421-1428 (2018)**
30. Seriani S, Gallina P, Scalera L, Lughì V, "Development of n-DoF preloaded structures for impact mitigation in cobots" *Journal of Mechanisms and Robotics* 10 (5), 051009 (2018)
29. Bernardini F, De Min A, Lenaz D, Kasztovszky Z, Lughì V, Modesti V, Tuniz C, Tecchiati U, "Polished stone axes from Varna/Nössingbühel and Castelrotto/Grondlboden, South Tyrol (Italy)", *Archaeolog. and Anthropological Sciences* 2018, 1-13 (2018)
28. Massi Pavan A, Vergura S, Mellit A, Lughì V, "Explicit empirical model for photovoltaic devices. Experimental validation", *Solar Energy* 155, pp 647-653 (2017)
27. Mauro G, Lughì V, "Mapping land use impact of photovoltaic farms via crowdsourcing in the Province of Lecce (Southeastern Italy)", *Solar Energy* 155, pp 434-444 (2017)
- 26. Slejko EA, Sayevich V, Cai B, Gaponik N, Lughì V, Lesnyak V, Eychmüller A, "Precise Engineering of Nanocrystal Shells via Colloidal Atomic Layer Deposition", *Chemistry of Materials* 29, pp 8111-8118 (2017)**
25. Boutana N, Mellit A, Lughì V, Massi Pavan A, "Assessment of implicit and explicit models for different photovoltaic modules technologies", *Energy* 122, pp 128-143 (2017)
24. Lenaz D, Lughì V, "Raman spectroscopy and the inversion degree of natural Cr-bearing spinels", *American Mineralogist* 102, pp 327-332 (2017)
23. Reveron H, Fornabaio M, Palmero P, Fürderer T, Adolfsson E, Lughì V, Bonifacio A, Sergio V, Montanaro L, Chevalier J, "Towards long lasting zirconia-based composites for dental implants: Transformation induced plasticity and its consequence on ceramic reliability", *Acta Biomaterialia* 48, pp 423-432 (2017)
22. Chine W, Mellit A, Lughì V, Sulligoi G, Massi Pavan A, "A novel fault diagnosis technique for photovoltaic systems based on artificial neural networks". *Renewable Energy* 90, pp 501-512 (2016)
21. Massi Pavan A, Tassarolo A, Barbini N, Mellit A, Lughì V, "The effect of manufacturing mismatch on energy production for large-scale photovoltaic plants". *Solar Energy* 117, pp 282-289 (2015)
- 20. Morales Vega M, Bonifacio A, Lughì V, Marsi S, Carrato S, Sergio V, "Long-term stability of surfactant-free gold nanostars". *Journal of Nanoparticle Research* 16, 2729 (2014)**
19. Mellit A, Massi Pavan A, Lughì V, "Short-term forecasting of power production in a large-scale photovoltaic plant". *Solar Energy* 105, pp. 401-413 (2014)
18. Spalatu N, Hiie J, Valdna V, Caraman M, Maticiu N, Mikli V, Potlog T, Krunks M, Lughì V, "Properties of CdCl<sub>2</sub> Air-annealed CSS CdTe Thin Films". *Energy Procedia* 44, pp. 85-95 (2014)
17. Massi Pavan A, Mellit A, Lughì V, "Explicit empirical model for general photovoltaic devices: Experimental validation at maximum power point". *Solar Energy* 101, pp. 105-116 (2014)
16. Massi Pavan A, Mellit A, De Pieri D and Lughì V, "A study on the mismatch effect due to the use of different photovoltaic modules classes in large-scale solar parks". *Prog. Photovolt: Res. Appl.* 22, pp. 332–345 (2014). First published online Sept 2012.
- 15. Lughì V, Bonifacio A, Barbone M, Marsich L, Sergio V, "Surface-enhanced Raman effect in hybrid metal-semiconductor nanoparticle assemblies". *Journal of Nanoparticle Research* 15 (5) , art. no. 1663 (2013)**
14. Lenaz D, Lughì V, "Raman study of MgCr<sub>2</sub>O<sub>4</sub>-Fe<sub>2</sub>+Cr<sub>2</sub>O<sub>4</sub> and MgCr<sub>2</sub>O<sub>4</sub>-MgFe<sub>2</sub> 3+O<sub>4</sub> synthetic series: The effects of Fe<sup>2+</sup> and Fe<sup>3+</sup> on Raman shifts". *Physics and Chemistry of Minerals* 40 (6) , pp. 491-498 (2013)
13. Review article: Lughì V and Sergio V, "Low temperature degradation -aging- of zirconia: A critical review of the relevant aspects in dentistry", *Dental Materials* 26 (8), 807 (2010).
12. Maticiu N.; Potlog T.; Hiie J.; Mikli V.; Pöldme N.; Raadik T.; Valdna V.; Mere A.; Gavrilo A.; Quinci F.; Lughì V.; Sergio V. Structural changes in chemically deposited CdS: Effect of Thermal Annealing. *Mold J. of Phys. Sciences.* 9 (3-4). pp.275-279 (2010)
11. Lughì V and Clarke DR, "Temperature Dependence of the Ytria-Stabilized Zirconia Raman Spectrum", *Journal of Applied Physics* 101, 053524 (2007).
10. Lughì V and Clarke DR, "Low Temperature Transformation Kinetics of Electron-Beam Deposited 5 wt% Ytria-Stabilized Zirconia", *Acta Materialia* 55, 2049 (2007).
9. Lughì V and Clarke DR, "Defect and Stress Characterization of AlN Films By Raman Spectroscopy", *Applied Physics Letters* 89, 241911 (2006).
8. Callaghan LA, Lughì V, Mac Donald NC, Clarke DR, "Beam-Supported AlN Thin Film Bulk Acoustic Resonators", *IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control* 53 [5] 1001-1007 (2006).
7. Gentleman MM, Lughì V, Nychka JA, Clarke DR, "Noncontact methods for measuring thermal barrier coating temperatures", *International Journal of Applied Ceramic Technology* 3 (2): 105-112 (2006).
6. Lughì V and Clarke DR, "High Temperature Aging of YSZ Coatings and Subsequent Transformation at Room Temperature", *Surface Coatings and Technology* 200 [5-6] 1287-1291 (2005).
5. Lughì V and Clarke DR, "Transformation of 8YSZ EB-PVD Ytria-Stabilized Zirconia Thermal Barrier Coatings", *Journal of the American Ceramic Society* 88 [9] 2552-2558 (2005).
4. Lughì V, Tolpygo VK, Clarke DR, "Microstructural aspects of the sintering of thermal barrier coatings", *Materials Science & Engineering A-Structural Materials Properties Microstructure & Processing* A368 [1-2] 212-21 (2004).
3. Lughì V, Colombi Ciacchi L, Kong CM, Lannutti JJ, Sergio V, "Piezo-spectroscopic determination of residual stresses in an Al/sub 2/O/sub 3/NiAl FGM", *Key Engineering Materials* 175-176, 183-8 (2000).
2. Colombi Ciacchi L, Gregori G, Lughì V, Rossi A, Sergio V, "Piezo-Spectroscopy: a Materials Science Perspective", *Recent Research Developments in Applied Spectroscopy* 2, 243-272 (1999).

1. Sergo V, Lughì V, Pezzotti G, Lucchini E, Meriani S, Muraki N, Katagiri G, Lo Casto S, Nishida T, "The effect of wear on the tetragonal-to-monoclinic transformation and the residual stress distribution in zirconia-toughened alumina cutting tools", Wear 214, [2], 264-70 (1998).

### **Book chapters**

- Morales Vega, M., Bonifacio, A., Lughì, V., Sergo, V (2015), Low-level Monoclinic content detection in zirconia implants using Raman spectroscopy. Nano-Structures for Optics and Photonics: Optical Strategies for Enhancing Sensing, Imaging, Communication and Energy Conversion, pp. 539-540
- Lughì V (2012), Optical and Electronic Properties. Springer Encyclopedia of Nanotechnology. Springer
- Lughì V (2012), Surface Energy and Chemical Potential at the Nanoscale. Springer Encyclopedia of Nanotechnology. Springer
- Lughì V. (2009), Fisica della conversione fotovoltaica. Manuale di Energia Solare. Tecniche Nuove

### **Patents**

Lughì V , Metodo per la realizzazione di un materiale fotovoltaico. RM2007A000652

Lughì V, Bonifacio A, Cozzarini L, Nanoparticelle per la rilevazione mediante spettroscopia di analiti e relativo procedimento di realizzazione.

### **Conference Proceedings**

Over 20 publications in proceedings of international conferences, not listed here

### **Presentations and Posters**

Over 30 presentations and posters at international conferences, not listed here. Additionally, invited talks are listed in a dedicated paragraph above