

PERSONAL INFORMATION

Name **MANCA MICHELE**
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Nationality **Italian**
Date of birth **26TH OF JUNE 1978**

MAIN FIELD OF INTEREST

ADVANCED PHOTOOELECTROCHEMICAL DEVICES for ENERGY CONVERSION and STORAGE

Engaged in 2009 July as team leader at the Italian Institute of Technology with the task to start up a strategic research line focused on the development of innovative multifunctional solar energy converting systems at the Center for Biomolecular Nanotechnologies in LECCE.

MM has thus promoted the creation of a multidisciplinary team of researchers and technologists possessing a relevant background of knowledge and skills on either photophysics, electrochemistry, and micro-/nano-fabrication technologies as well as a consolidate experience in the development of both academic and industrial projects.

MM has coordinated and managed the building-up of a new world-class laboratory devoted to synthesis and functionalization of hybrid organic/inorganic nanomaterials, to the fabrication of multifunctional dye-sensitized photoelectrochemical cells and to the photochemical and electrochemical characterization of materials and devices.

Main target of his current research activities is the implementation of smart photovoltaic systems capable to generate and accumulate electrical power, but also to perceive small variations in external radiation and to control the energy fluxes control and sensing by means of a smart variation of the optical transmittance. This would be a key point in the perspective of novel generation smart components to be integrated in building facades.

R&D EXPERIENCE

**Since 2012
(ongoing project)**

@ Center for Biomolecular Nanotechnologies - Italian Institute of Technology
• *Implementation of smart photovoltachromic windows*

Industrial partner: **Tozzi Renewable Energy Group** www.tre-energia.com
position: **TECHNICAL MANAGER**

2008-2010

@ National Nanotechnology Laboratory of CNR - Italy
• *Design and fabrication of durable transparent super-hydrophobic coatings on glass and plastic substrates*

Industrial partner: **TEUCO GUZZINI** www.teuco.it
position: **R&D ENGINEER**

2006-2008

@ National Nanotechnology Laboratory of CNR - Italy
• *Design and fabrication of bell-shaped micro-lens arrays capable*



to enhance light out-coupling efficiency and tailor intensity distribution of red OLEDs for automotive backlighting
Industrial partner: ASTRON FIAMM <http://www.astron-fiamm.com/en/>
position: R&D ENGINEER

2004-2006

@ National Nanotechnology Laboratory of CNR - Italy

- *Design and fabrication of advanced optical components for OLED-based illumination systems*

Industrial partner: iGUZZINI ILLUMINAZIONE www.iguzzini.it
position: JUNIOR RESEARCHER

EDUCATION

2006-2009

Scuola Superiore ISUFI- University of Salento – LECCE (ITALY)

PhD in NANOSCIENCES defining a thesis on: “*Design and fabrication of large area nanostructured engineered surfaces for lighting and photovoltaics*”

1997-2004

University of Salento – LECCE (ITALY)

MSc in Materials Engineering. Graduated with full marks (110/110) defining a thesis on “*Fabrication and characterization Organic Light Emitting Diodes (OLEDs) with improved light outcoupling efficiency*”

LANGUAGES

ITALIAN: mother tongue

ENGLISH: fluent

SPANISH: fluent

TECHNICAL SKILLS and COMPETENCES

MICRO-/NANO-FABRICATION TECHNIQUES

- Thin films deposition by screen-printing , spin-coating, dip-coating
- Thin films deposition by sputtering, thermal evaporation, electronic beam assisted evaporation
- Micro-/nano-structured surfaces fabrication:
 - photolithography
 - plasma reactive ion etching
 - wet etching
 - non-conventional lithographic techniques: nanospheres lithography
 - soft-lithographic techniques: hot-embossing, injection-molding
- Meso- and nanostructured electrodes made by colloidal nanocrystals

CHARACTERIZATION TECHNIQUES

- Electrochemical Impedance Spectroscopy
- Cyclic voltammetry
- Z-potential
- BET surface area/porosimetry analysis
- Electroluminescence Measurements
- Color Rendering Index measurements
- Confocal Microscope measurements
- Time resolved spectroscopy (photo-induced electron absorption, single-photon counting)
- Morphological analysis by Atomic Force Microscope (AFM)
- Morphological analysis by Scanning Electron Microscope (SEM)
- Contact Angle and Surface Energy measurements



PATENTS

- ◆ **Manca M.**, Gigli G., Guzzini A. - WORLD PATENT **WO2009044269**
LIGHTING APPLIANCE HAVING A REDUCED ENCUMBRANCE
WITH EFFECTIVE CONTROL OF THE PHOTOMETRIC
DISTRIBUTION OF EMITTED LIGHT
- ◆ **Manca M.**, Gigli G., Guzzini A. - WORLD PATENT **WO2009044263**
OPTICAL SCREEN FOR DIRECTING LIGHT BEAMS WITH
ELEMENTS HAVING AN OPTIMIZED GEOMETRY
- ◆ **Manca M.**, De Marco L., Gigli G. - EUR. PATENT **EP200808425399**
DOUBLE LAYER COATING, ITS PREPARATION AND ITS USE FOR
RENDERING ULTRA WATER-REPELLENT AND ANTIREFLECTIVE
THE SURFACES TO WHICH IT IS APPLIED
- ◆ **Manca M.**, Cannavale A., Cingolani R. and Gigli G. - **WO 2014002076**
PHOTOVOLTACHROMIC DEVICE WITH INTERDIGITATED
ELECTRODES



PUBLICATIONS

- ◆ **Manca M.**, Beke S.; De Marco L.; Pareo P.; Qualtieri A.; Cannavale A.; Brandi F.; Gigli G. "A 3D Photoelectrode for Dye Solar Cells Realized by Laser Micromachining of Photosensitive Glass" *J. Phys. Chem. C*, **2014**, DOI: 10.1021/jp501254k
- ◆ Agosta R., Grisorio R., De Marco L., Iacobellis R., Suranna G.P., Mastrolilli P., Gigli G., **Manca M.** "An engineered co-sensitization system for highly " *ChemComm*, **2014**, DOI: 10.1039/c4cc01801j
- ◆ Nunzi F., Storchi L., **Manca M.**, Giannuzzi R., Gigli G., De Angelis F. "Shape and Morphology Effects on the Electronic Structure of TiO_2 Nanostructures: from nanocrystals to nanorods" *ACS Appl. Mat. & Interf.* **2014**, 6 (4), 2471–2478
- ◆ Giannuzzi R., **Manca M.**, De Marco L., Belviso M., Giannini C., Cozzoli P.D. and Gigli G. "Ultrathin $TiO_2(B)$ nanorods with superior Lithium-ion storage performances" - *ACS Appl. Mat. & Interf.*, **2014**, 6 (3), 1933–1943
- ◆ Cannavale A., **Manca M.**, De Marco L., Grisorio R., Carallo S., Suranna G.P., and Gigli G. "Fully integrated photovoltaic devices with a micropatterned bi-functional counter electrode" - *Appl. Mat. & Interf.*, **2014**, DOI: 10.1021/am404800m
- ◆ Grisorio R., Agosta R., De Marco L., Iacobellis R., Suranna G.P., **Manca M.**, Mastrolilli P., Gigli G. "Enhancing dye-sensitized solar cell performances by small structural modification: toward highly efficient π extended organic sensitizers" – *ChemSusChem*, **2014** in press
- ◆ A. Alberti, L. De Marco, G. Pellegrino, G. Condorelli, R. Giannuzzi, R. Scarfiello, **M. Manca**, C. Spinella, G. Gigli and A. La Magna "Combined Strategy to Realize Efficient Photoelectrodes for Low Temperature Fabrication of Dye Solar Cells" *Appl. Mat. & Interf.*, **2014**, DOI: 10.1021/am4058524
- ◆ De Marco L., Di Carlo G., Giannuzzi R., **Manca M.**, Riccucci C., Ingo G., Gigli G. "Highly Efficient Photoanodes for Dye Solar Cells With a Hierarchical Meso-ordered Structure" *PCCP*, **2013**, 15, 16949-16955
- ◆ **Manca M.**, De Marco L., Giannuzzi R., Agosta R., Dwivedi C., Qualtieri A., Dutta V., Gigli G. "TiO₂ nanorods-based photoelectrodes for dye solar cells with tunable morphological features" *Thin Solid Films*, **2013**, <http://dx.doi.org/10.1016/j.tsf.2013.10.155>
- ◆ Milionis A., Giannuzzi R., Bayer i., Papadopoulou E., Ruffilli R., **Manca M.**, Athanassiou A. "Self-Cleaning Organic/Inorganic Photo-Sensors" *ACS Appl. Mat. & Int.*, **2013**, 5 (15), 7139–7145
- ◆ De Marco L., **Manca M.**, Giannuzzi R., Belviso M., Cozzoli P.D. and Gigli G. "Shape-tailored TiO_2 nanocrystals with synergic peculiarities as building blocks for highly efficient multi-stack dye solar cells", *EN. & ENV. SCI.* **2013**, 6 (6) , pp. 1791-1795
- ◆ Agosta R., Giannuzzi R., De Marco L., **Manca M.**, Cozzoli P.D. and Gigli G. "An electrochemical assessment of the band-edge positioning in shape-tailored TiO_2 -nanorods-based photoelectrodes for dye solar cells" *J. PHYS. CHEM. C* - **2013**, 117 (6), pp 2574–2583
- ◆ Grisorio R., De Marco L., Allegretta G., Giannuzzi R., Suranna G.P., **Manca M.**, Mastrolilli P., Gigli. G. "Anchoring stability and photovoltaic



properties of new D(-π-A) 2 dyes for dye-sensitized solar cell applications" DYED AND PIGMENTS, **2013**, 98 (2), PP. 221-231

- ◆ Malara F., **Manca M.**, Lanza M., Hubner C., Piperopoulos E. and Gigli G. "A free-standing aligned-carbon-nanotubes/nanocomposite foil as efficient counter electrode for dye solar cells" EN. & ENV. SCI., **2012**, 5, 8377-8383
- ◆ De Gregorio G.L., Agosta R., Giannuzzi R., Martina F., De Marco L., **Manca M.** and Gigli G. "Highly stable gel electrolytes for dye solar cells based on chemically engineered polymethacrylic hosts" CHEM COMM., **2012**, 48, 3109-3111
- ◆ Giannuzzi R., **Manca M.** and Gigli G. "A new electrical model for the analysis of a partially shaded dye-sensitized solar cells module" PROG. PHOTOV.: RES. & APPL., **2012**, DOI: 10.1002/pip.2219
- ◆ Cannavale A., **Manca M.**, Malara F., De Marco L., Cingolani R. and Gigli G. "Highly efficient smart photovoltaic devices with tailored electrolyte composition". EN. & ENV. SCI., **2011**, 4, 2567-2574
- ◆ De Marco L., **Manca M.**, Buonsanti R., Giannuzzi R., Malara F., Pareo P., Martiradonna L., Giancaspro N., Cozzoli P.D. and Gigli G. "High-quality photoelectrodes based on shape-tailored TiO₂ nanocrystals for dye solar cells". J. MAT. CHEM. **2011**, 21, 13371-13379
- ◆ Malara F., **Manca M.**, Giannuzzi R., De Marco L., Pareo P., Cingolani R. and Gigli G. "Flexible carbon nanotubes-based composite plates as efficient monolithic counterelectrodes for dye solar cells". APPL. MAT. INT., **2011**, 3 (9), 3625-3632
- ◆ Buonsanti, R.; Carlino, E.; De Marco, L.; Giannuzzi R.; **Manca, M.**; Gigli, G.; Cozzoli, P. D.; "Synthesis of branched titanium dioxide nanocrystals and their use for the fabrication of efficient photoelectrodes for dye solar cells" J. AM. CHEM. SOC. , **2011**, 133 (47), 19216–19239
- ◆ Grisorio R., Mastrolilli P., Suranna G.P., Cosma P., De Marco L., **Manca M.**, Gigli. G. "The Suzuki-Heck polymerization as a Tool for the Straightforward Obtainment of Poly(fluorenylene-vinylene) Sensitizers for Dye-Sensitized Solar Cells" J. POLYM. SCI. A , **2011**, 49 (4), 842-847
- ◆ De Marco L., **Manca M.**, Melcarne G., Malara F., Ciccarella G., Cingolani R. and Gigli G. "Novel preparation method of TiO₂-nanorods-based photoelectrodes for dye-sensitized solar cells with improved light harvesting efficiency" J. PHYS. CHEM. C. , **2010**, 114 (9), pp 4228–4236
- ◆ Pareo P., De Gregorio G., **Manca M.**, Pianesi M.S., Cavallaro F., De Marco L., Pappada' S.., Ciccarella G. and Gigli G. "Ultra lightweight PMMA-based composite plates with robust super-hydrophobic surfaces" - J. COLL. INT. SCI. **2011**, 362 (2) , 668-675
- ◆ Melcarne G., De Marco L., Carlino E., Martina F., **Manca M.**, Cingolani R., Gigli G and Ciccarella G., "Surfactant-free synthesis of pure anatase TiO₂ nanorods suitable for dye-sensitized solar cells" J. MAT. CHEM , **2010**, 20, 7248-7254
- ◆ **Manca M.**, Malara F., Martiradonna L., Giannuzzi R., De Marco L.,



**ORAL PRESENTATIONS
@ INTERNATIONAL
CONFERENCES**

- Cingolani R. and Gigli G. "Charge recombination reduction in dye-sensitized solar cells by means of an electron beam-deposited TiO₂ buffer layer between conductive glass and photoelectrode" THIN SOLID FILMS, **2010**, 518 (23), 7147–7151
- ◆ Cannavale A., Fiorito F., **Manca M.**, Tortorici G., Cingolani R. and Gigli G. "Multifunctional bionspired sol-gel coatings for architectural glass" BUILDING and ENVIRONMENT, **2010**, 45 (5), pp 1233–1243
- ◆ **Manca M.**, Cannavale A., De Marco L., Aricò A., Cingolani R. and Gigli G. "Durable super-hydrophobic and antireflective surfaces by trimethylsilanized-silica-nanoparticles-based sol-gel processing" LANGMUIR, **2009**, 25, 6357-6362
- ◆ **Manca M.**, Cortese B., Viola I., Aricò A.S., Cingolani R., Gigli G. "Influence of Chemistry and Topology Effects on Super-Hydrophobic CF₄-Plasma-Treated PDMS" LANGMUIR **2008**, 24, 1833-1843
- ◆ Cortese B., D'Amone S., **Manca M.**, Viola I., Cingolani R., Gigli G. "Superhydrophobicity of a hierarchical tier-scale roughness on PDMS surfaces" LANGMUIR **2008**, 24, 2712-2718
- ◆ **Manca M.**, Quercetti F., Gattari M., Cingolani R. and Gigli G. "Highly efficient photometrics tailoring by means of optimized bell-shaped lenses" PROCEEDING of SPIE Vol7103 - 27 (**2008**)
- ◆ European Clusters on Photovoltaics **2013** – Barcelona (SPAIN) on behalf of the scientific coordinator of the FP7th project ESCORT
- ◆ INTERNATIONAL MEETING on PV **2013** – Hyderabad (INDIA)
- ◆ E-MRS 2013 Spring Meeting – Strasbourg (FRANCE)
- ◆ HOPV 2013 – Sevilla (SPAIN)
- ◆ FUTURMAT2 **2012** – Riva Marina di Ostuni (ITALY) (invited speaker)
- ◆ E-MRS 2012 – Strasbourg (FRANCE)
- ◆ NANOFORUM.IT **2011**- Rome (ITALY) (invited speaker)
- ◆ E-MRS 2011 Fall Meeting – Warsaw (POLAND)
- ◆ E-MRS 2011 Spring Meeting - Nice (FRANCE)
- ◆ HOPV2011- Valencia (SPAIN)
- ◆ NANOENERGY **2011**- Natal (BRASIL)
- ◆ HOPV2010 – Assisi (ITALY)
- ◆ NANOTEC.IT **2009** – Rome (ITALY)
- ◆ SPIE **2008** - Glasgow (SCOTLAND)



PROJECTS

MM has been coordinating (since 2012 June) the R&D activities carried out by IIT in the framework of the national project **MAAT** (Molecular nAnotechnology for heAlth and environmenT), which aims at creating a technological platform for Industrial Research based on Molecular Nanotechnology processes for the development of innovative systems and functional equipments for the next generation of Building-Integrated PV technologies. The final target is represented by the fabrication of semitransparent smart windows in which energy production and storage, illumination and dynamic solar control are combined.

In this framework he managed and carried out the recruiting procedures of five skilled post-doctoral researchers.

An overall budget of around **2 MEUR** has been granted to IIT. More than **250 kEUR** will be devoted to the acquisition and installation of advanced facilities for fabricating energy conversion devices which will definitively became part of CBN instrumentation capital.

MM has been managing the research activities of IIT in the framework of an ambitious European project on Dye Solar Cells, namely **ESCORT** (<http://www.escort-project.eu>).

MM has presented the most relevant technological achievements delivered in the ESCORT framework at the last Workshop on EU PV clusters held on November 2103 in Barcelona.

An overall budget of around **450 kEUR** has been granted to IIT

MM has promoted and managed the activation of a commercial R&D program sponsored by Tozzi Renewable Energy Group aimed at supporting and managing a series of industrial-driven activities on the development of smart photovoltaic systems which are going to be carried out in the **IIT-TOZZI joint lab set up in November 2013 at CBN**.

An overall budget of **120 kEUR** has been made available by TOZZI group.

LECCO
14/07/2014

