

Carlo S. Casari CV

Full Professor in Physics of Matter (FIS/03) at Politecnico di Milano, Department of Energy, Italy.

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Research activity

My scientific interests regard:

- 1) the bottom-up growth of nanostructures and their structure-property relationships as a function of size and quantum confinement.
- 2) the functional properties and potential applications of nanostructured materials obtained by the assembling of nano-sized structures as building blocks.

In particular, I am interested in the study of structural, electronic, optical and transport properties of isolated and assembled nanostructures with the aim of developing capability to design and realize novel systems and materials with nano-engineered properties.

Since 2000 I have been working on nanostructured carbon-based systems such as cluster-assembled carbon films, nanotubes and carbon atomic wires. Since 2004 I have been working on the fabrication and characterization of nanostructured films and surfaces of metal oxides and semiconductors for catalysis, biotechnology, gas sensing and energy applications (photovoltaics, thermoelectrics and water splitting). In particular, I work on material synthesis by pulsed laser deposition (PLD) and on material characterization by inelastic light scattering (Raman and surface enhanced Raman scattering - SERS) and scanning probe techniques such as scanning tunnelling microscopy and spectroscopy (STM/STS) and atomic force microscopy (AFM).

In 2016 I got an ERC Consolidator Grant (<https://erc.europa.eu/>) for the 5-years project (2017-2022) EspLORE – Extending the Science Perspectives of Linear wires Of carbon from fundamental Research to Emerging materials, funded with about € 2.000.000. The project EspLORE aims at developing novel functional carbon coatings, films and nanocomposites based on sp-hybridized carbon-atom wires to fill the existing gap between fundamental science and engineering (www.esplora.polimi.it). In 2019 I got an ERC Proof-of-Concept grant for the project PROTECHT and in 2023 the ERC Proof-of-Concept grant PYPAINTE which are aimed at exploiting EspLORE research outputs for possible business opportunities. PROTECHT results led to a patent filing. In 2021, with the team ENIGMA I won the Switch2Product innovation prize by PoliHub, the Startup Lombardia and the Italian prize for innovation PNI. In 2023 I got a EIC Transition grant with the project KEEPER.

Career

I graduated in Electronic Engineering (mathematics-physics track) at Politecnico di Milano in 1999. In 2000-2001 I had a research fellowship from the National Institute for Physics of Matter (INFM) and in 2004 I received *cum laude* my Ph.D. in Materials Engineering working, under the supervision of C.E. Bottani, on carbon-based nanostructured materials. 2004-2005 I had a post doc position at Politecnico di Milano and in 2005 I had a permanent position as assistant professor at Politecnico di Milano. In 2009 I joined the Department of Energy. In 2014, after getting the Italian National Scientific Qualification for Associate Professor in Experimental Physics of Matter I got a position as Associate Professor. Since 2017 I am in the list of Top Italian Scientist (TIS) by Via Academy. In 2017 I got the Italian National Scientific Qualification for full professor in Experimental Physics of

Matter and in 2019 I was appointed as Full Professor in Experimental Physics of Matter at Politecnico di Milano.

Teaching activity

I am currently teaching an introductory course in nanotechnology at the Bachelor degree in Materials Engineering and Nanotechnology (10 CFU – 100 hours) and since 2012 '*Physics of Nanostructures*' (5 CFU – 50 hours) in the Master degree. From 2012 to 2018 I taught '*Introduction to Nanoscience & Introduction to Quantum Physics*' (5 CFU – 50 hours) for master students in Materials Engineering and Nanotechnology, Nuclear Engineering, Biomedical Engineering, Mechanical Engineering. I also teach in the course '*Material Characterization with Labs*' (module on AFM, STM) of the PhD programme in Materials Engineering.

Since 2001 I have been teaching as assistant lecturer in courses of fundamental physics, Solid State Physics, Micro and Nanotechnology, Introduction to Nanotechnology for Materials Engineers, Nuclear Engineers and Physics Engineers (Bachelor and Master). In 2008 and 2009, I was in charge of the course '*Physical Properties of Materials*' (Bachelor degree in Materials Engineering). In 2009, I taught a module on '*Carbon Nanostructures*' (25 hours) in the course '*Micro and Nanotechnology*' (Master in Engineering Physics). Up to now I directly supervised more than 10 PhD and more than 30 Master and 25 Bachelor thesis students as supervisor or co-supervisor.

Publication records

I have a total of more than 170 publications: more than 130 Web of Science (WoS) papers (in about 50 different journals including 2 Phys. Rev. Lett., 11 Phys. Rev. B., 6 Appl. Surf. Sci., 3 Appl. Phys. Lett., 3 Carbon, 3 J. Phys. Chem. C, 2 Langmuir, Nano Letters, ACS Nano, Adv. Funct. Mat., Adv. Energy Mat., Nanoscale), 6 invited contributions to volume and more than 20 conference proceedings. These papers are distributed in the following ISI-WoS categories: 38% Physics Condensed Matter; 35% Materials Science Multidisciplinary; 35% Physics Applied; 17% Nanoscience Nanotechnology; 15% Materials Science Coatings Films.

Since 2001 my record of publications has a total of 4200 citations, Hirsch-index = 37, percentage of hetero-citations >87% (source Web of Science) and a total of 5700 citations, Hirsch-index = 42, i10-index = 75, (source Google Scholar). I am co-author of more than 120 orals and posters presented at conferences.

Academic responsibilities

- 2018 – present: vice-president of the Degree Commission of Materials Engineering and Nanotechnology
- 2014 - 2017: Secretary of the Degree Commission for the Bachelor Programme in Materials Engineering and Nanotechnology
- 2013 - 2014: Member of the Department Committee for Teaching Activities
- 2015 - present: Member of the Academic Board for the PhD Programme in Energy and Nuclear Science and Technology
- 2010 – present: Member of the Permanent Commission of the Study Programme in Materials Engineering and Nanotechnology (Bachelor and Master programme)
- Faculty member of the study programmes in Materials Engineering and Nanotechnology, Nuclear Engineering, Biomedical Engineering and Mechanical Engineering

Reviewer activity

I have been referee for international journals (more than 370 reviewed manuscripts, see publons.com/a/1183320/) of AIP (Applied Physics Letters), IOP (Nanotechnology, Journal of Physics: Condensed Matter), ACS (The Journal of Physical Chemistry), Elsevier (Carbon, Chemical Physics Letters, Surface Science, Applied Surface Science), Springer (Journal on Nanoparticle

Research), Wiley (Journal of Raman Spectroscopy), Royal Society of Chemistry RSC (Nanoscale, Advances in Chemistry) and Nature Publishing (Scientific Reports).

From 2012 Member of the panel of experts (RePrise - Register of Expert Peer Reviewers for Italian Scientific Evaluation) for reviewing projects of the Italian Ministry for University and Research (MIUR). Reviewer for SIR projects of the Italian Ministry for University and Research (MIUR). Expert for projects review of the Research Foundation - Flanders (Fonds Wetenschappelijk Onderzoek - Vlaanderen, FWO) Belgium. Expert for projects review of the National Plan for Research, Development and Innovation 2007-2013, PN II (National Authority for Scientific Research ANCS), Romania. Expert for projects review of DFG national German funding agency.

Memberships

Member of the editorial board of:

2016 – present: Editorial Board of Applied Sciences (MDPI-Multidisciplinary Digital Publishing Institute, Switzerland) Impact Factor: 2.226 (2018)

2014 – present: Member of the International Advisory Panel of Materials Research Express (IOP Publishing) Impact Factor: 1.449 (2018)

- 2015 – 2017: Editorial Board of Journal of Photoenergy (Hindawi, USA)

- 2011 – 2014: Editorial Board of ISRN Nanotechnology (Hindawi, USA)

2014 – present: Member of the Materials and Nanotech. Committee of the Engineering Council of Milan

Member of the American Chemical Society (ACS), the Materials Research Society (MRS) and of the Italian Association of Science and Technology (AIV). Since 2010 is affiliated to the Center for NanoEngineered Material and Surfaces (NEMAS) and to the Center for Nano Science and Technology CNST of the Italian Institute of Technology IIT@POLIMI. Member of the nanotechnology and materials commission of Ordine degli Ingegneri della Provincia di Milano.