

Curriculum Vitae

Andrea Bianco – Born in Milan (Italy), April 4, 1975.

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Education

2004 Ph.D. degree in Materials Engineering at the Politecnico di Milano in collaboration with the Brera Astronomical Observatory. Dissertation's title: "New Organic Materials for Optical Elements in Astronomy". Supervisor: Prof. G. Zerbi;

08/2003 – 02/2004: Visiting scholar at University of Delaware (USA). Supervisor Prof. J. Rabolt;

2000: Master Laurea Degree in Materials Engineering at the Politecnico di Milano (grade 100/100).

Employment

03/2010 – present: Researcher at INAF – Osservatorio Astronomico di Brera;

10/2005 – 02/2010: Tenure Track Researcher at INAF – Istituto di Astrofisica Spaziale e Fisica Cosmica (IASF) di Milano;

2005 – present: Adjunct Professor at Politecnico di Milano;

09/2004 – 08/2005: PostDoc Position at the Politecnico di Milano researching functional nanofibers obtained with the electrospinning technique.

Research activity

My research activity aims to develop reliable devices with the required target performances, not only a "proof of concept". This can be possible by considering problems in its entirety, understanding the target "astronomical" performances and developing the suitable materials considering all the open issues. This conceptual research path can proceed in both directions: starting from the material and arriving at the device, or starting from the astronomical device and developing the suitable material.

My research activity started with my Master's thesis work on the determination of structure-property relationship in functional organic materials showing nonlinear optical properties. I then started a PhD in Materials Engineering at the Politecnico di Milano in collaboration with the Brera Astronomical Observatory. The work aimed at applying some new functional materials to astronomical instrumentation. This allowed me to start interacting with astronomers and researchers in the field of astronomical instrumentation, thus making it possible to build a "bridge" between the high-end requirements typical of the astronomical environment and the opportunities provided by chemical and materials engineering. Being in contact with astronomers, engineers, and chemists, one of my main efforts has been to develop a "common language" between researchers with completely different backgrounds, which is, in my opinion, a necessity for having important and original outcomes.

My attention, since the beginning of my PhD, has focused on the study and development of innovative functional materials for making optical devices in astronomy. The first output was the development of rewritable photochromic focal plane masks for multi-object spectroscopy. I then studied the modulation of the refractive index in photochromic materials for manufacturing Volume Phase Holographic Gratings (VPHGs). More recently, my research activity considered photochromic materials for making rewritable and adaptable devices with high optical quality to be used in interferometry. In particular, I studied the possibility of making photochromic Computer Generated Holograms (CGHs) and an adaptable photochromic Point Diffraction Interferometer. At the same time, I have been involved in research projects regarding the development of new CGH based techniques for testing large adaptive mirrors. Another research topic focuses at the design and manufacturing of VPHGs for astronomical instrumentation based on new materials (photopolymers) in collaboration with companies.

Since I started as a tenure track researcher, a research group devoted to the study of functional materials for astronomical applications has grown up, exploiting the fruitful collaboration with the Politecnico di Milano also thanks to my Adjunct Professor position. This allowed me to start supervising undergraduate, graduate, and PhD students working on my research topics. Recently, a chemistry laboratory has been installed at the

Brera Astronomical Observatory in order to cover all the stages in development of the materials and astronomical devices.

Scientific Production

The next table summarizes the scientific production:

Total number of papers in refereed journals (review paper)	64 (4)
H-index (source SCOPUS/Google Scholar)	19/22
Total number of citations (source SCOPUS/Google Scholar)	1150/1364
Proceeding (SPIE, IEEE, ...)	83
Number of talks at international conferences and workshops (invited)	32 (7)
Patents	2

Invited Talks

Advances in photochromic computer-generated holograms SPIE Optics + Optoelectronics, Holography: Advances and Modern Trends, 1 – 4 April 2019, Prague (Czech Republic)

Photochromic materials: the tool for making a reconfigurable platform for rewritable phase and amplitude holograms Optical MicroSystem (OMS' 17), 11 – 14 September 2017, Anacapri (Italy)

New photosensitive systems for volume phase holography, SPIE Optics + Optoelectronics, Holography: Advances and Modern Trends, 24 – 27 April 2017, Prague (Czech Republic)

Photochromic materials for astronomy: the role of molecular spectroscopy, 33rd European Congress on Molecular Spectroscopy, 30 July – 4 August 2016, Szeged (Hungary)

Materials for VPHGs: practical considerations in the case of astronomical instrumentation, SPIE 2012 Astronomical Telescopes + Instrumentation, 1–6 July 2012, Amsterdam, (Netherlands)

New Opportunities with Photochromic Materials: Beyond the Change of Color, International Conference on Nanomaterials and Nano Ethics, 1 – 3 December 2011, Lahore (Pakistan)

Organic Photochromic Materials for Astronomical Applications, OPTICON Key Technology Network Workshop, 20-21 October 2005, Rome (Italy)

Selected publications:

- [1] Quintavalla, M., Baratto, M., Natali, D., Bonora, S., Bertarelli, C., Bianco, A., “Fully Organic Photocontrolled Deformable Mirror,” *Adv. Opt. Mater.* **6**(19), 1800361, (2018).
- [2] Pariani, G., Castagna, R., Oggioni, L., Colella, L., Nardi, A., Anzani, S., Bertarelli, C., Bianco, A., “Adaptable Microcontact Printing via Photochromic Optical-Saturable Lithography,” *Adv. Mater. Technol.* **3**(3), 1700325 (2018).
- [3] Oggioni, L., Toccafondi, C., Pariani, G., Colella, L., Canepa, M., Bertarelli, C., Bianco, A., “Photochromic Polyurethanes Showing a Strong Change of Transparency and Refractive Index,” *Polymers* **9**(9), 462 (2017).
- [4] Pariani, G., Quintavalla, M., Colella, L., Oggioni, L., Castagna, R., Ortica, F., Bertarelli, C., Bianco, A., “New Insight into the Fatigue Resistance of Photochromic 1,2-Diarylethenes,” *J. Phys. Chem. C* **121**(42), 23592–23598 (2017).
- [5] Bianco, A., Ferrari, G., Castagna, R., Rossi, A., Carminati, M., Pariani, G., Tommasini, M., Bertarelli, C., “Light-induced dipole moment modulation in diarylethenes: a fundamental study,” *Phys. Chem. Chem. Phys.* **18**(45), 31154–31159 (2016).
- [6] Zanutta, A., Orselli, E., Fäcke, T., Bianco, A., “Photopolymeric films with highly tunable refractive index modulation for high precision diffractive optics,” *Opt. Mater. Express* **6**(1), 252–263 (2016).

- [7] Bianco, A., Coppola, C., Ferrara, M. A., Pariani, G., Bertarelli, C., "Analysis of phase patterns in photochromic polyurethanes by a holographic approach," *Opt. Mater. Express* **5**(10), 2281–2291 (2015).
- [8] Toccafondi, C., Occhi, L., Cavalleri, O., Penco, A., Castagna, R., Bianco, A., Bertarelli, C., Comoretto, D., Canepa, M., "Photochromic and photomechanical responses of an amorphous diarylethene-based polymer: a spectroscopic ellipsometry investigation of ultrathin films," *J. Mater. Chem. C* **2**(23), 4692–4698 (2014).
- [9] Bertarelli, C., Bianco, A., Castagna, R., Pariani, G., "Photochromism into optics: Opportunities to develop light-triggered optical elements," *J. Photochem. Photobiol. C Photochem. Rev.* **12**(2), 106–125 (2011).
- [10] Bianco, A., Perissinotto, S., Garbugli, M., Lanzani, G., Bertarelli, C., "Control of optical properties through photochromism: a promising approach to photonics," *Laser Photon. Rev.* **5**(6), 711–736 (2011).

Teaching Activity

Since 2004, I have been carrying out teaching activity at the Politecnico di Milano mainly in the school of Chemical Engineering and Materials Engineering.

A.Y. 2005/2006 – present: Full course "Metodi per la caratterizzazione microstrutturale dei materiali", (*Microstructural Characterization of Materials*) 60 hrs;

A.Y. 2005/2006 – present Lecturer "Photochromic Materials" for the course "Materials for Design" at the Politecnico di Milano, Industrial Design.

A.Y. 2004/2005 – 2006/2007: Support teaching activity for the course "Materiali funzionali Organici" (*Organic Functional Materials*)

A.Y. 2004/2005 – 2005/2006: Support teaching activity for the course "Struttura dei materiali macromolecolari" (*Structure of Macromolecular Materials*)

Supervising Student Activity

Since 2006, I started an activity of students supervising at the Politecnico di Milano. I have been supervisor of ten thesis works and co-supervisor of about twenty thesis works in Chemical Engineers and Materials Engineers. More recently, I have been supervisor of four PhD students in Materials Engineering. The four students are involved in research activities concerning the study of new functional materials for optical applications.