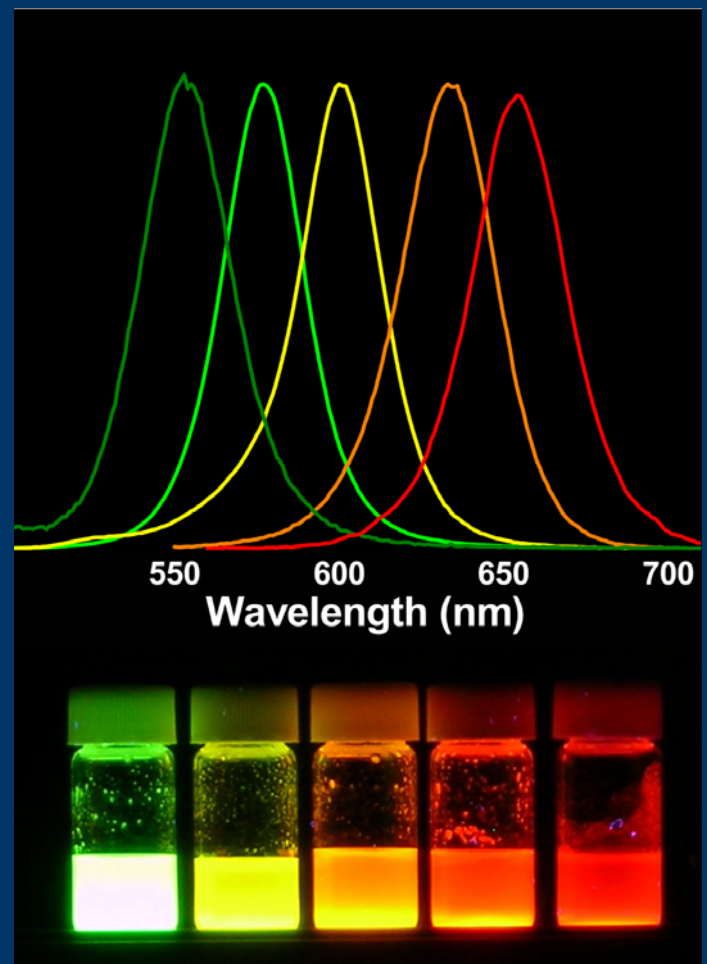
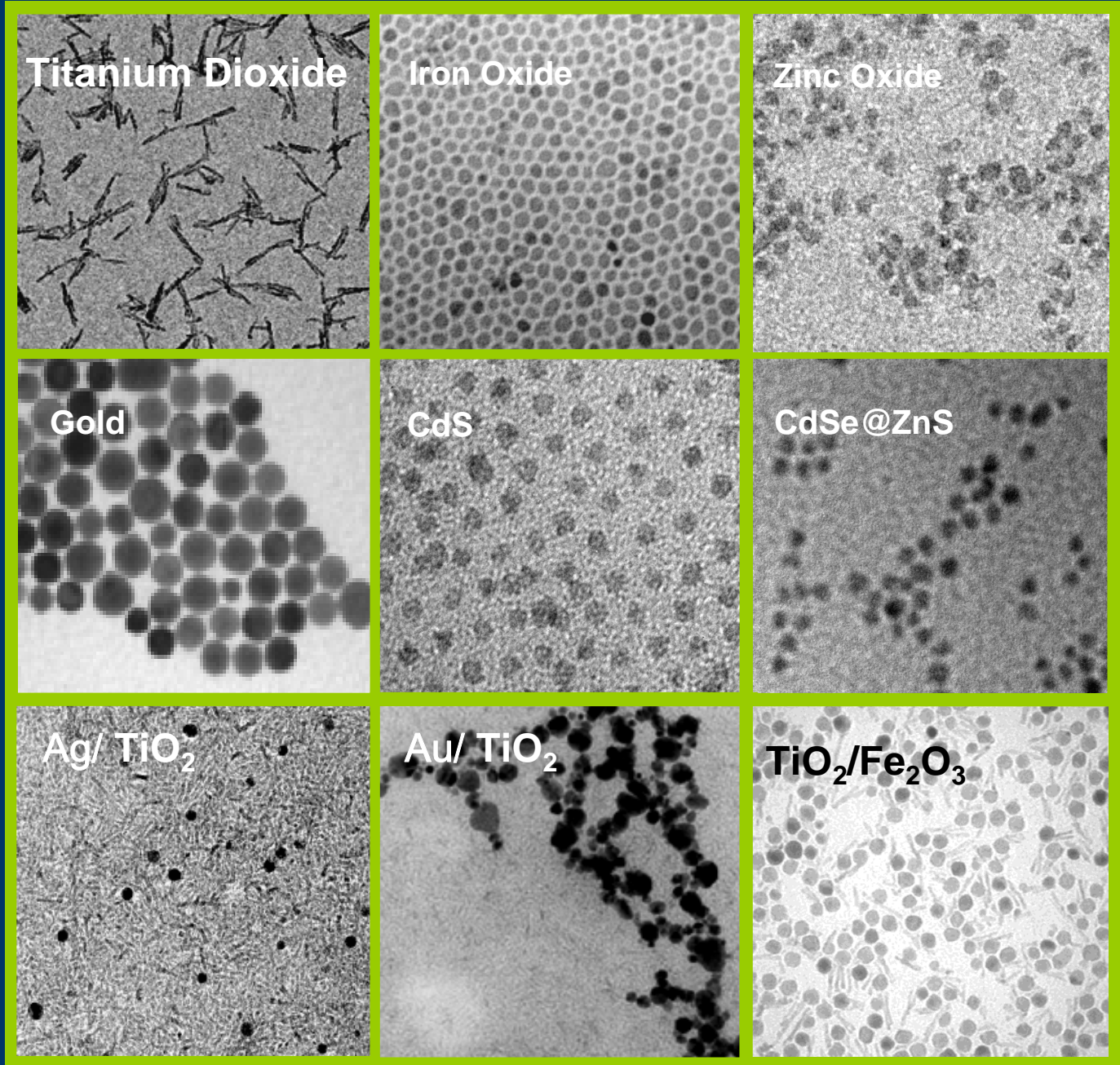


At Nanolab CNR IPCF Bari Division research activities aim to design, fabricate and process inorganic solids at the nanoscale for bridging the gap between chemical synthesis and conventional top-down techniques

Original size dependent physical and chemical properties arise when matter is manipulated at nanoscale. New synthetic procedures, investigation of the nanostructured material properties and design of methodologies to convey their peculiar characteristics into functional materials for application and integration in devices are among the main goals



# Nanocrystals “à la carte”



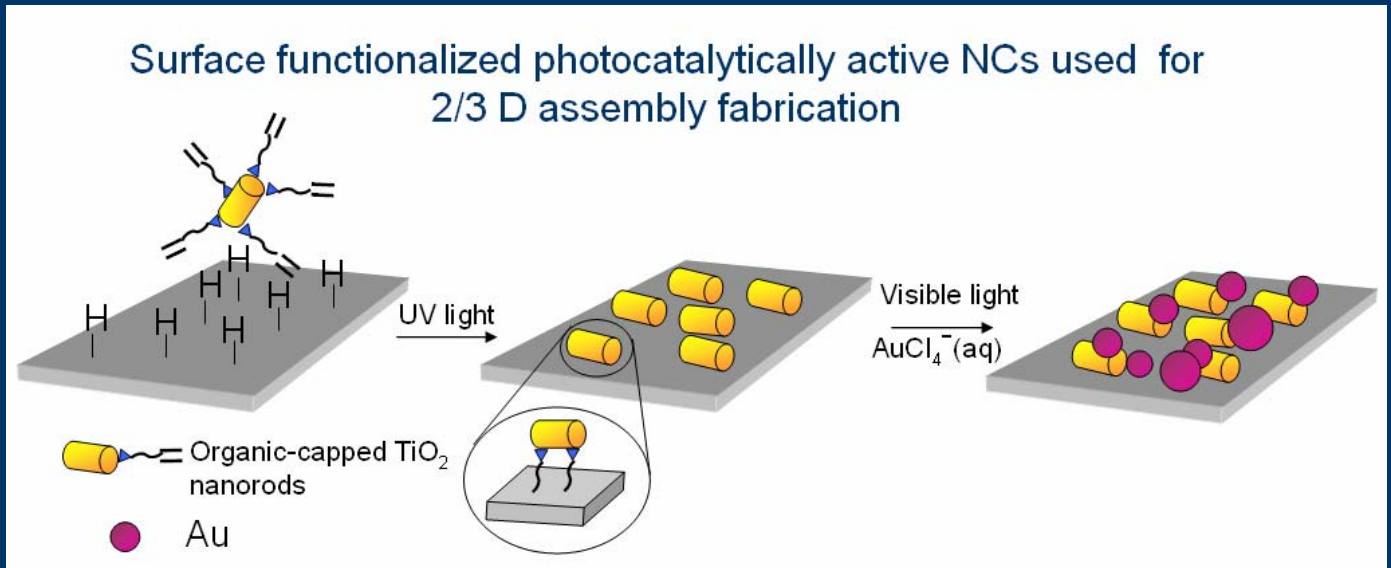
Nanocrystals are synthesized by colloidal chemistry routes with high control on size, shape and crystallinity, thus accessing nanostructured materials, also multifunctional in nature, with a fine tuning of their chemical and physical properties.

Functionalization procedures are developed to purposely vary the nanocrystal surface chemistry in order to place them virtually in any chemical environment

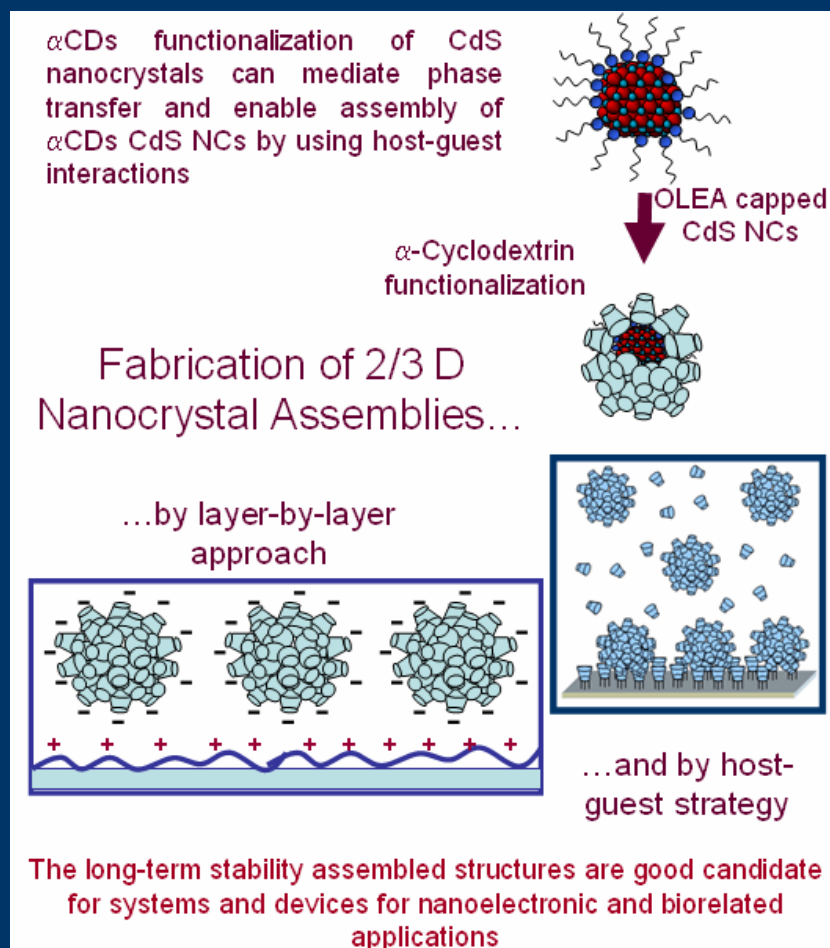
Characterization of the colloidal nanocrystals are performed by using spectroscopical (UV-vis-NIR absorption, luminescence, FTIR, XPS), structural (transmission microscope, X-ray powder diffraction) and morphological (AFM) techniques

# Colloidal Nanocrystal 2/3 D Assembly

Organization of the functionalized nanocrystals in 2/3 D hierarchical structures by directed assembly, soft lithography, layer-by-layer and standard deposition techniques and functionalized nanocrystal positioning onto selected substrates



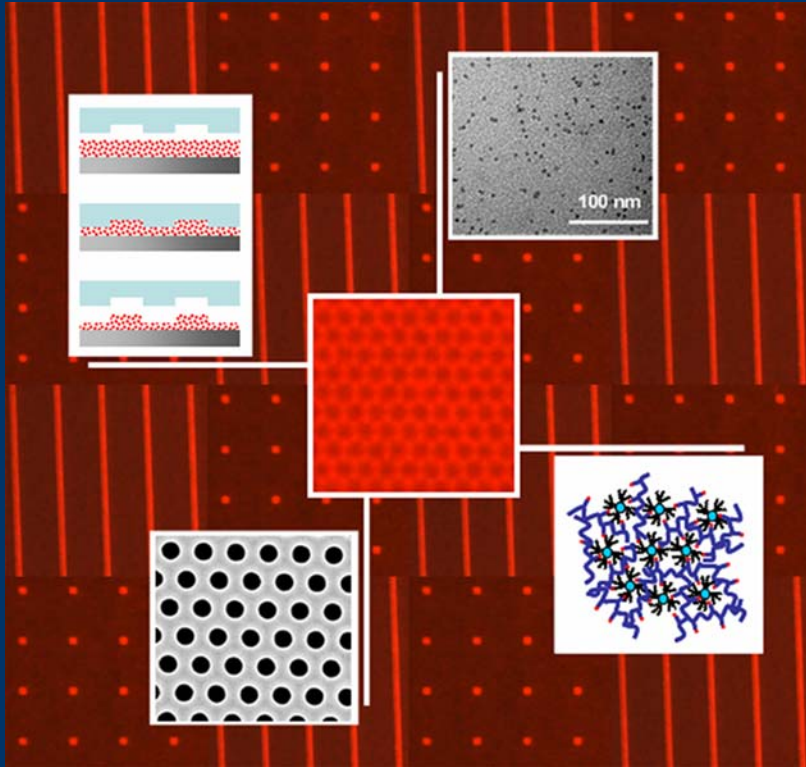
E. Fanizza, P. D. Cozzoli, M. L. Curri, M. Striccoli, E. Sardella, A. Agostiano (2007)  
*Advanced Functional Materials*, 17 201-211.



N. Depalo, R. Comparelli, M. Striccoli, M. L. Curri, P. Fini, L. Giotta, A. Agostiano *J. Phys. Chem B* (2006), 110, 17388-17399

# Nanocrystal Based Functional Nanocomposites

Preparation and characterization of nanocomposites based on organic polymer and semiconductor nanocrystals, their deposition as thin film. Nanocrystal based nanocomposites for micro and nanofabrication by means of lithographic techniques, such as Nano Imprint Lithography and ...



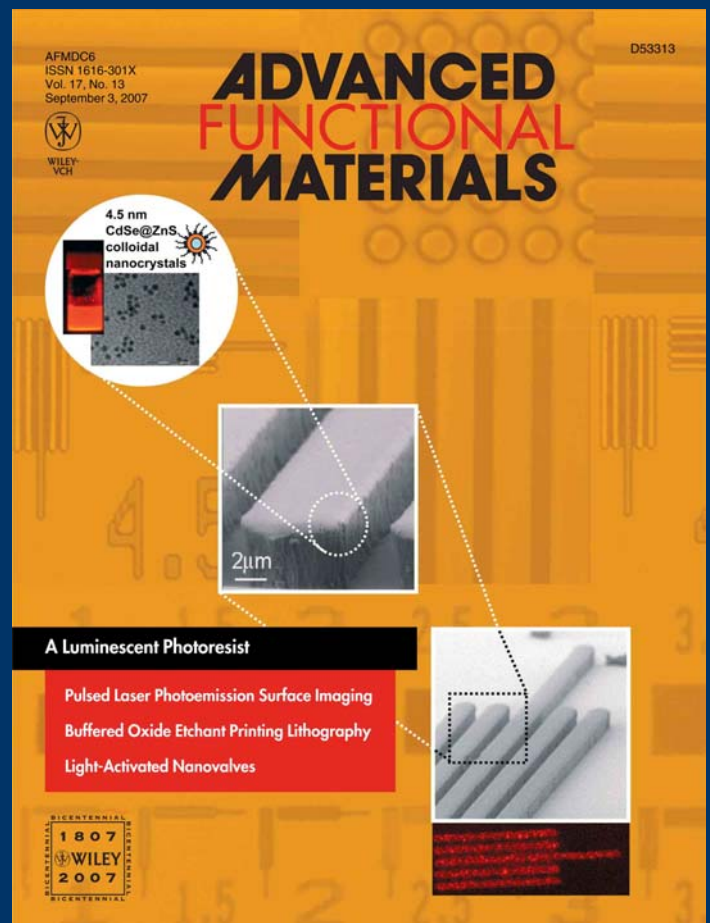
## Nanocrystal Based Luminescent Composites for Nano Imprinting Lithography

M. Tamborra, M. Striccoli, M. L. Curri, J. A. Alducin, D. Mecerreyes, J. A. Pomposo, N. Kehagias, V. Reboud, C. M. Sotomayor Torres, A. Agostiano (2007) *Small* 3, 822 – 828.

and UV photolithography

Luminescent nanocrystal modified epoxy photoresist for the fabrication of 3-D high aspect-ratio microstructures

Ingrosso, V. Fakhfour, M. Striccoli, A. Agostiano, A. Voigt, G. Gruetzner, M. L. Curri, J. Brugger (2007) *Adv. Funct. Mater.* 17, 2009–2017.



And also:

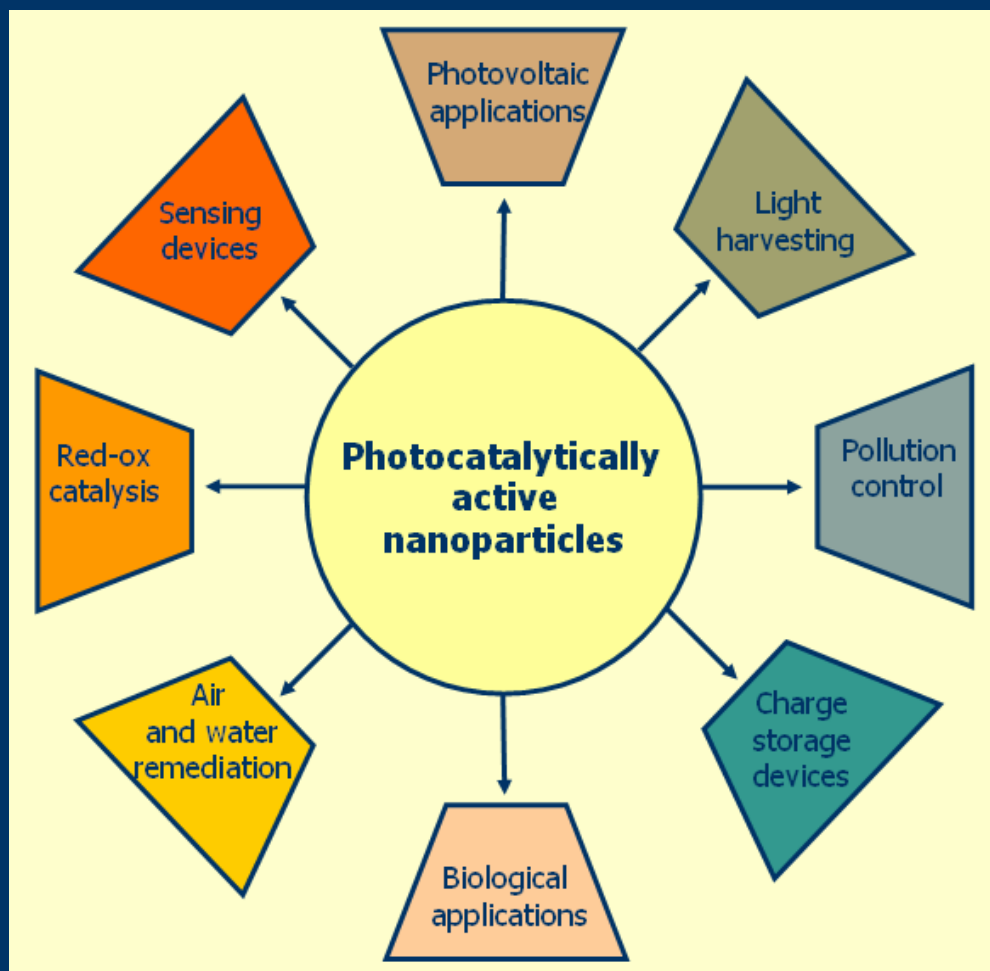
Photodegradation of organic compounds in aqueous and organic environment assisted by oxide nanoparticles properly supported

Synthesis of metal/oxide nanocrystal composite and their application in red-ox processes as bifunctional photocatalysts and charge storage experiments

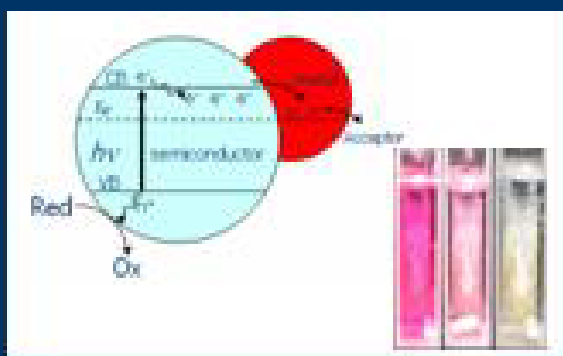
Hybrid heterojunctions based on conducting conjugated polymers and semiconducting inorganic nanocrystals for energy conversion experiments

Modified electrodes formed by nanocrystal based films and sensitizer, such as phtalocyanins: photoelectrochemical investigation

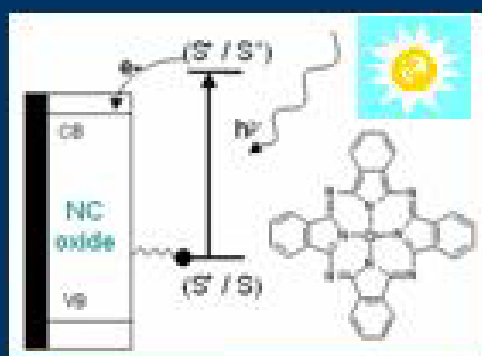
Test of the optelectronic properties of the prepared materials in optical sensing elements



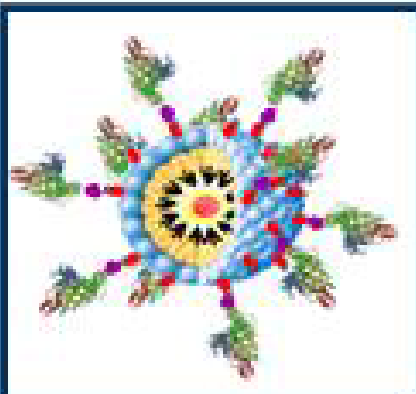
# Colloidal Nanocrystals based Materials: Applications



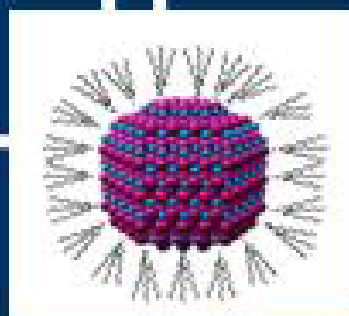
**catalysis**



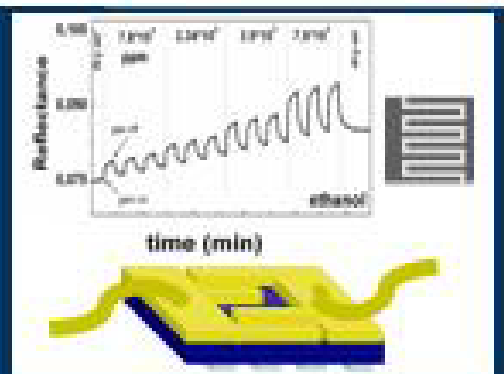
**energy conversion**



**bioconjugation**



**sensing**



- C. Ingrosso, A. Petrella, M. L. Curri, M. Striccoli, P. Cosma, P. D. Cozzoli, A. Agostiano "Photoelectrochemical properties of hybrid junctions based on zinc phthalocyanine and semiconducting colloidal nanocrystals" (2006) *Electrochimica Acta*, 51, 5120–5124
- R. Comparelli, E. Fanizza, M. L. Curri, P. D. Cozzoli, G. Mascolo, R. Passino, Agostiano "Photocatalytic Degradation of Azo Dyes by Organic-Capped Anatase TiO<sub>2</sub> Nanocrystals Immobilized onto Substrates" *Applied Catalysis B: Environmental* (2005) 55, 81-91.
- P. D. Cozzoli, R. Comparelli, E. Fanizza, M. L. Curri, A. Agostiano, D. Laub "Role of Metal Nanoparticles in TiO<sub>2</sub>/Ag Nanocomposite-Based Homogeneous Photocatalysis" *J. Phys. Chem. B* (2004) 108(28); 9623-9630.
- M. Tamborra A. Petrella, M. L. Curri, M. Striccoli, P. Cosma, P. D. Cozzoli, A. Agostiano "Colloidal TiO<sub>2</sub> nanocrystals / MEH-PPV: nanocomposites: (Photo)electrochemical study" *J. Phys. Chem. B.* (2005) 109, 1554 – 1562.
- M.G. Manera, P. D. Cozzoli, M. L. Curri, G. Leo, R. Rella, A. Agostiano, L. Vasanelli "TiO<sub>2</sub> nanocrystal films for sensing applications based on surface plasmon resonance" *Synthetic Metals* (2005) 148, 25-29.

# Selected Publications

- C. Ingrosso, V. Fakhfour, M. Striccoli, A. Agostiano, A. Voigt, G. Gruetzner, M. L. Curri, J. Brugger "Luminescent nanocrystal modified epoxy photoresist for the fabrication of 3-D high aspect-ratio microstructures" *Adv. Funct. Mater.* (2007) 17, 2009–2017.
- M. Tamborra, M. Striccoli, M. L. Curri, J. A. Alducin, D. Mecerreyes, J. A. Pomposo, N. Kehagias, V. Reboud, C. M. Sotomayor Torres, A. Agostiano "Nanocrystal based luminescent composites for nano imprinting lithography" *Small* (2007) 3, 822 – 828.
- Convertino, G. Leo, M. Tamborra, C. Sciancalepore, M. Striccoli, M. L. Curri, A. Agostiano "TiO<sub>2</sub> colloidal nanocrystals functionalization of PMMA: a tailoring of optical properties and chemical adsorption" *Sensors and Actuators B*, (2007) 126, 138–143.
- V. Reboud, N. Kehagias, M. Zelsmann, M. Striccoli, M. Tamborra, M. L. Curri, A. Agostiano, M. Fink, F. Reuther, G. Gruetzner, C. M. Sotomayor Torres "Spontaneous emission control of colloidal nanocrystals using nanoimprinted photonic crystals" *Appl. Phys. Lett.*(2007) 90, 011115.
- E. Fanizza, P. D. Cozzoli, M. L. Curri, M. Striccoli, E. Sardella, A. Agostiano "UV-light driver immobilization of surface-functionalized oxide nanocrystals onto silicon" *Adv. Funct. Mater.* (2007) 17 201-211.
- Ingrosso, A. Petrella, P. Cosma, M. L. Curri, M. Striccoli, A. Agostiano "Hybrid junctions of Zn(II) and Mg(II) phthalocyanine with wide band gap semiconductor nano-oxides: spectroscopical and photoelectrochemical characterization" *J. Phys. Chem. B* (2006) 110(48); 24424-24432.
- N. Depalo, R. Comparelli, M. Striccoli, M. L. Curri, P. Fini, L. Giotta, A. Agostiano " $\alpha$  Cyclodextrin functionalized CdS nanocrystals for fabrication of 2/3 D Assemblies" *J. Phys. Chem B* (2006), 110, 17388-17399.
- M. G.Manera, G. Leo, M. L. Curri, R. Comparelli, R. Rella, A. Agostiano, L. Vasanelli "Determination of optical parameters of colloidal TiO<sub>2</sub> nanocrystals-based thin films by using surface plasmon resonance measurements for sensing applications" *Sensors and Actuators B* (2007) 126 138–143.
- R. Comparelli, M. L. Curri, E. Fanizza, P. D. Cozzoli, G. Mascolo, A. Agostiano "UV-induced Photocatalytic Degradation of Azo Dyes by Organic-Capped ZnO Nanocrystals Immobilized onto Substrate" *Applied Catalysis B: Environmental* (2005) 60, 1–11.
- M. Tamborra A. Petrella, M. L. Curri, M. Striccoli, P. Cosma, P. D. Cozzoli, A. Agostiano "Colloidal TiO<sub>2</sub> nanocrystals / MEH-PPV: nanocomposites: (Photo)electrochemical study" *J. Phys. Chem. B.* (2005) 109, 1554 – 1562.
- P. D. Cozzoli, R. Comparelli, E. Fanizza, M. L. Curri, A. Agostiano, D. Laub "Photocatalytic Synthesis of Ag Nanoparticles Stabilized by TiO<sub>2</sub> Nanorods: a Semiconductor/Metal Nanocomposite in Homogeneous Nonpolar Solution" *J. Am. Chem. Soc.* (2004) 126(12); 3868-3879.

# Collaborations and networks

CNR IPCF Pisa and Messina Divisions  
CNR IRSA Bari Division  
CNR IC Bari Division  
CNR IMM Lecce Division  
CNR ICCOM Bari Division  
CNR ISMN Roma Division  
CNR-INFM LICRYL Cosenza Division  
Università di Bari – Dipartimento di Geologia  
Università di Bari - Dipartimento di Fisica  
Università di Firenze – INSTM Dipartimento di Chimica  
Università di Lecce – Dip. Ing. dell'Innovazione  
Università di Palermo – Dip. Chimica Inorganica ed Analitica  
CIDETEC San Sebastian (Spain)  
CNM- CSIC Barcelona (Spain)  
EPFL Lausanne (Switzerland)  
MIC Technical University of Denmark (Denmark)  
MRT Berlin (Germany)  
IBM Ruschlikon (Switzerland)  
INASMET San Sebastian (Spain)  
Tyndall National Institute Cork (Ireland)  
University of Twente (The Neatherlands)



**Università degli  
Studi di Bari**



## Funding



**NaPa**  
*Emerging Nanopatterning Methods*

Integrated Project of 6th EU  
FP *NaPa* “*Emerging  
Nanopatterning Methods*”



STREP Project of 6th EU FP  
NOVOPOLY “*Novel functional  
polymer materials for MEMS and  
NEMS applications*”



*MIUR funding  
programmes*



*Explorative Project by Apulia Region  
within the Scientific Research  
Framework Program 2006*

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