



UNIVERSIDAD
NACIONAL DE
SAN MARTÍN

INS
INSTITUTO DE
NANOSISTEMAS

De la Nanociencia a la Nanotecnología, low cost del diseño al mercado

Galo Soler Illia

Instituto de NanoSistemas, UNSAM

www.unsam.edu.ar/institutos/ins



INS - Establecido en 2015

6 PI + 2 nuevos PI en 2018

Proyectos de Investigación

- **Diseño de Nanomateriales**
- **Interacción célula-superficie**
- **BioSensores**
- **Nano-óptica**
- **Nanomedicina**
- **Adsorbentes**

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Galo Soler Illia
Nanoarchitectures



Diego Pallarola
Cell-Surface



Mariana Hamer
Sensors



Marina Simian
Cancer + nano



Gastón Corthey
Laser femto



Fernanda Cardinal
Plasmonics

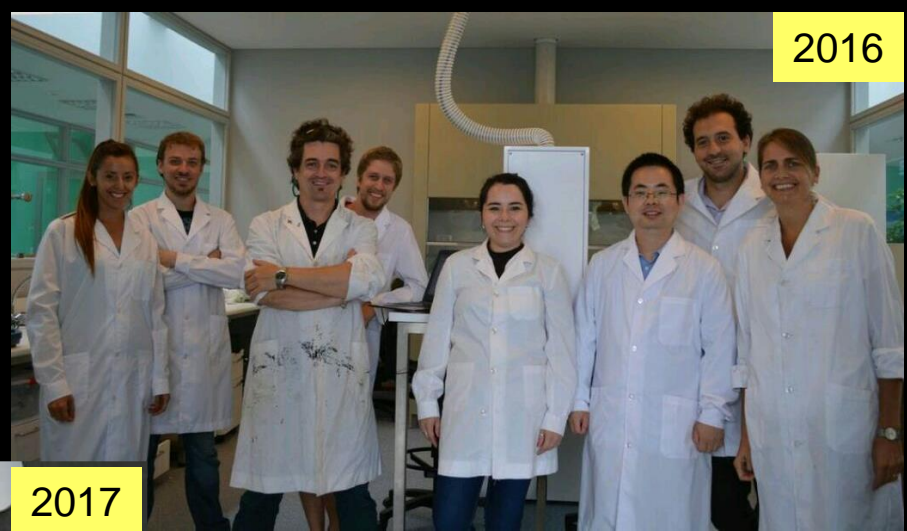


Instituto de Nanosistemas
INS UNSAM





2015



2016



2017



2018

6 CONICET Researchers
8 postdocs
12 PhD students
6 technicians
**4 Central labs (Synthesis,
Bio, laser characterization)**

#OrgulloUNSAM

Falso dilema

“Ciencia Útil” vs. “Ciencia pura”

- Ciencia básica, esencial para el desarrollo
- Aplicaciones pueden ser inspiración para preguntas de frontera

Ekimov (1981)

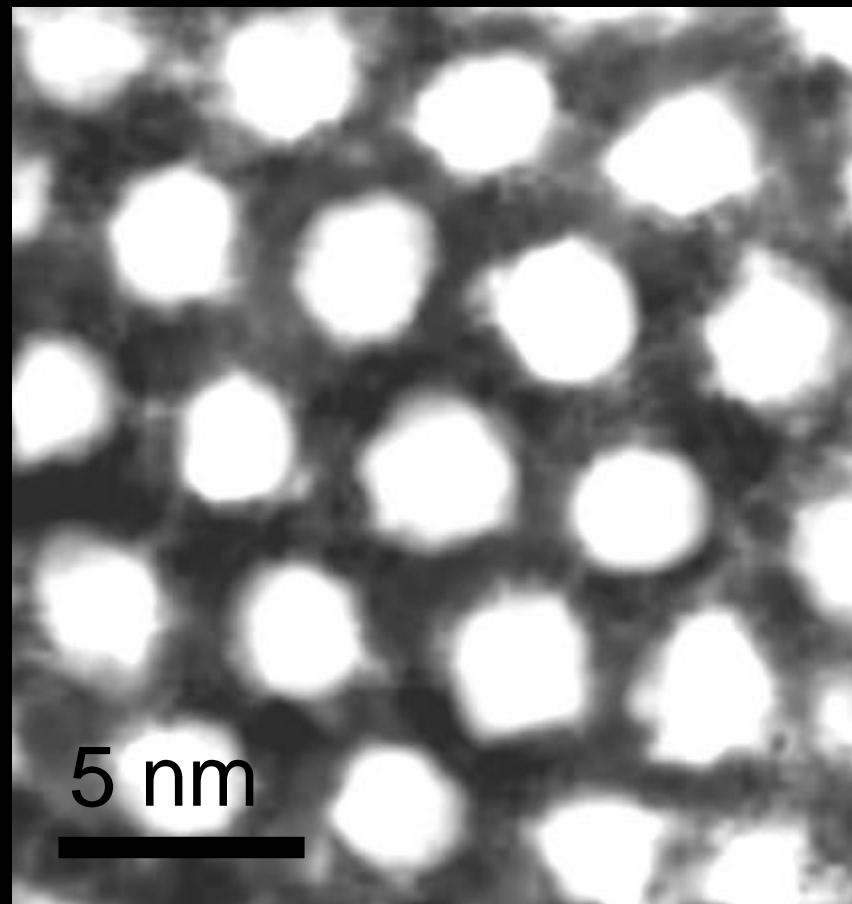
Bawendi-Alivisatos-Murray (1995)

Alivisatos-Nanosys (2001)

2015- TV y tablets
25 ton anuales



Materiales Mesoporosos

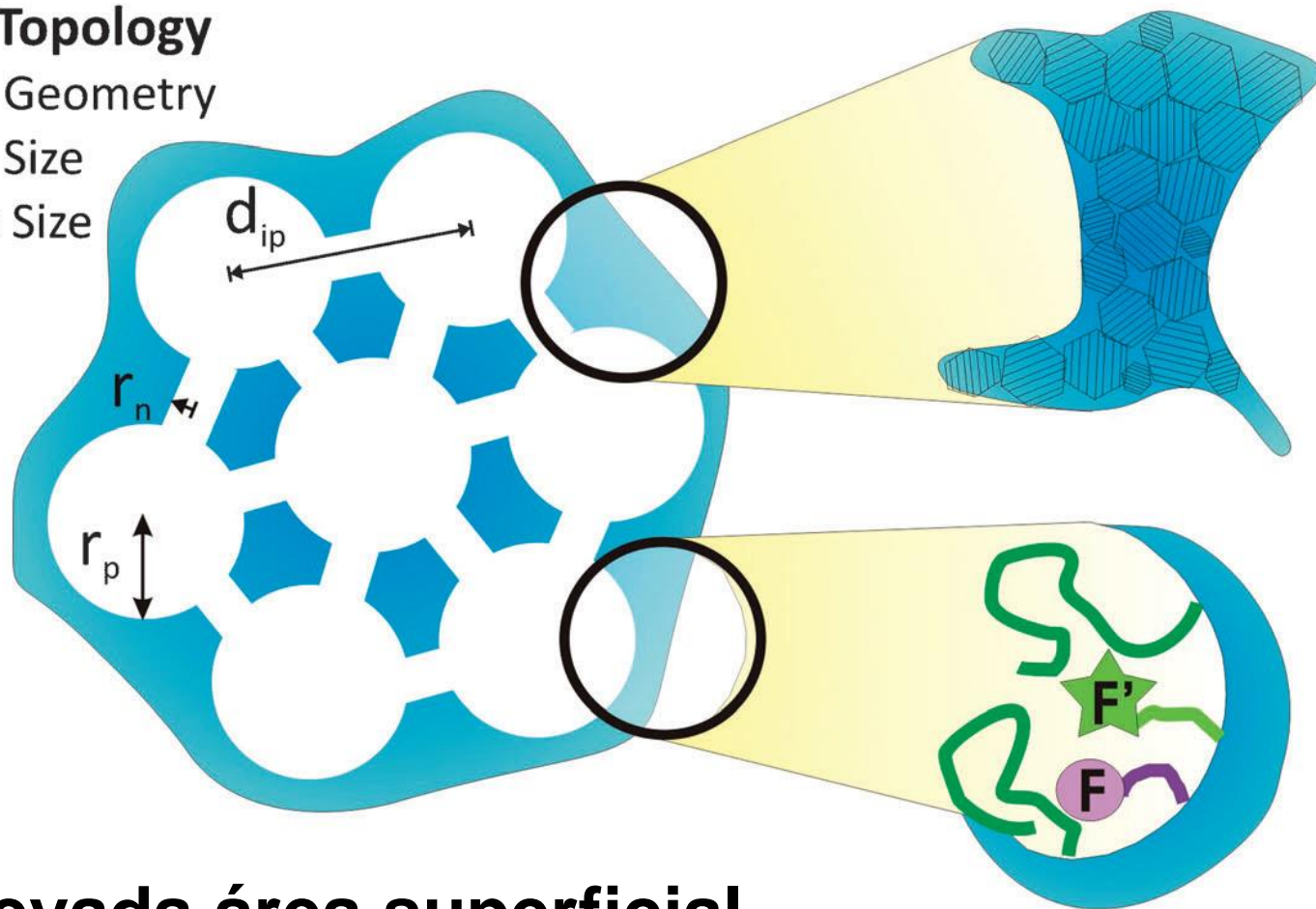


Pore Topology

Pore Geometry

Pore Size

Neck Size



Wall Nature

Composition
Crystal structure
Crystallite size
Organic functions

Interface Nature

Surface functions
Interactions

Pore filling

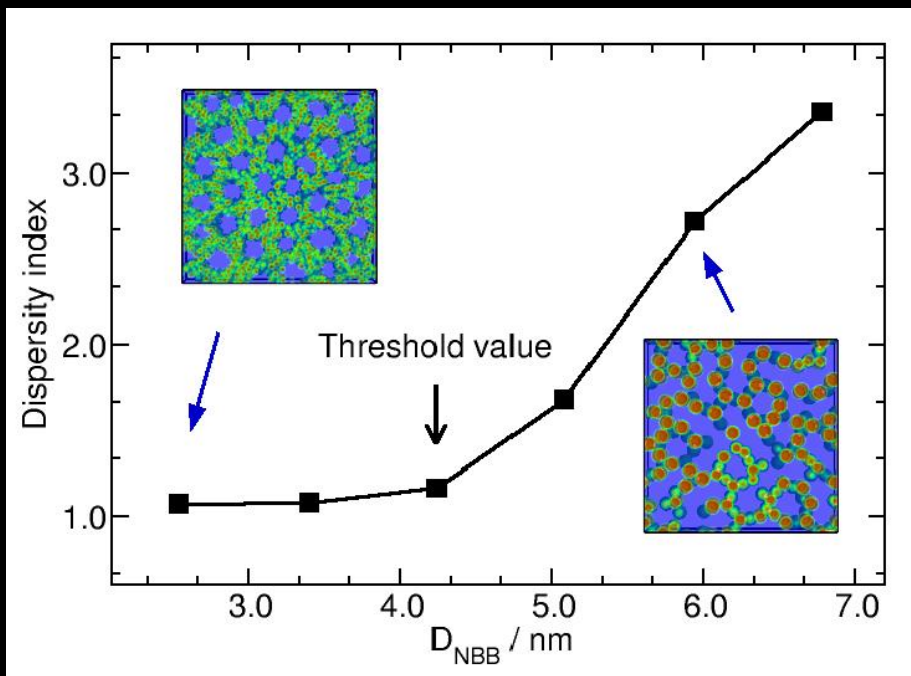
Elevada área superficial
Superficies modulables
Efectos de Confinamiento

Soler-Illia, Sanchez, Lebeau, Patarin., *Chem. Rev.*, **2002**

Soler-Illia and Azzaroni., *J. Sol-Gel Sci. Tech.*, **2011** *Chem. Soc. Rev.*, **2011**

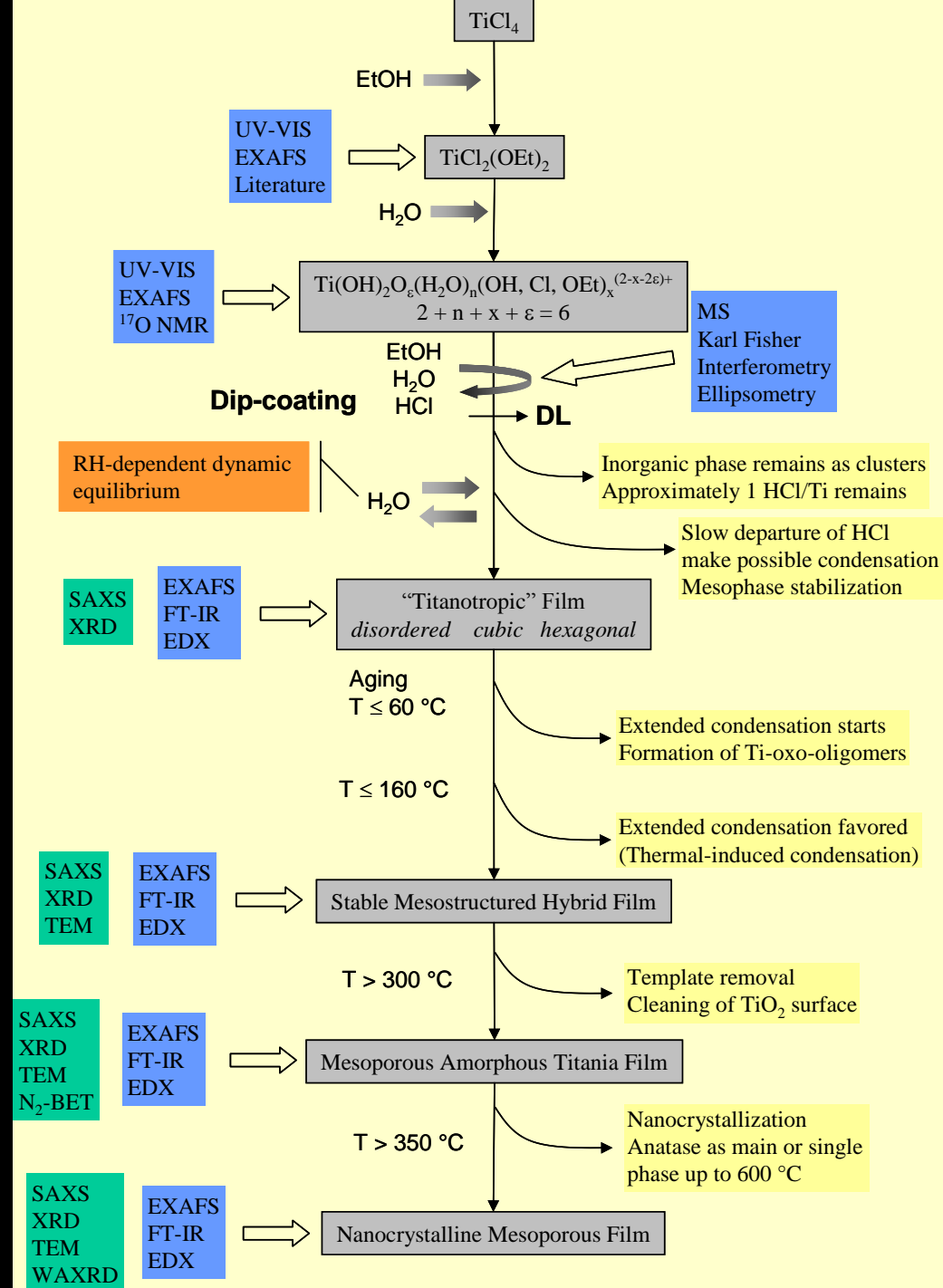
Soler-Illia et al., *Nanoscale.*, **2012**; S. Alberti et al., *Chem. Commun.*, **2015**

Material complejo = multitécnicas y teoría



E. Crepaldi et al, *JACS*, 2003

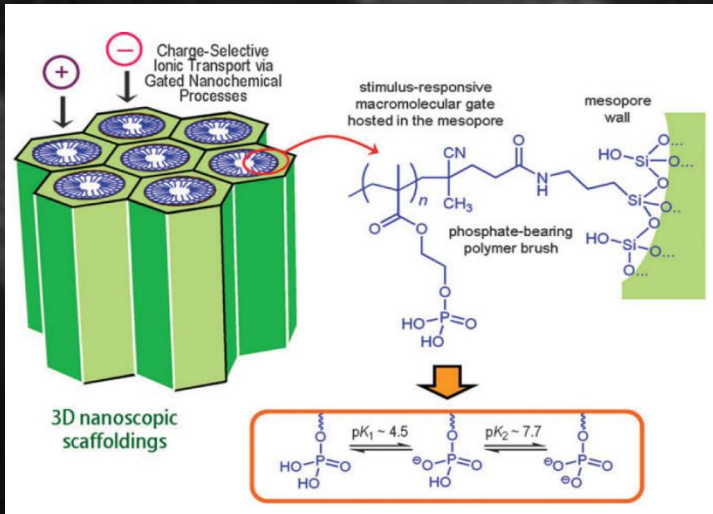
Q. Tang et al., *Phys. Chem. Chem. Phys.*, 2017



Nanosistemas integrados

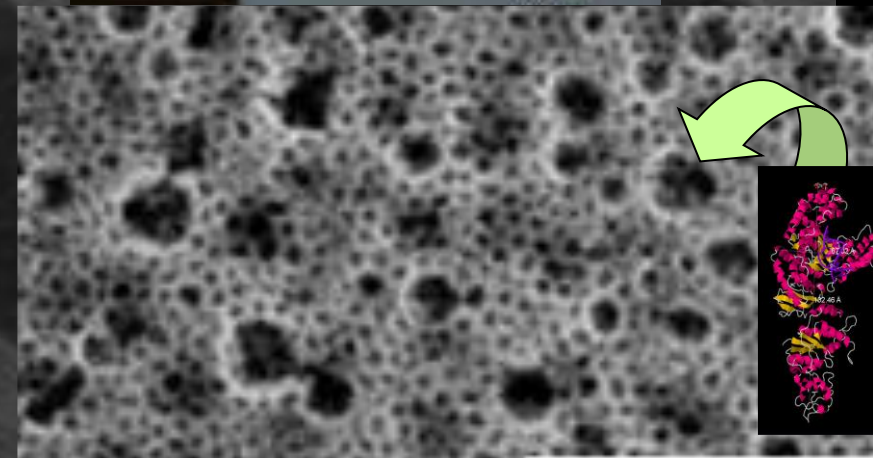
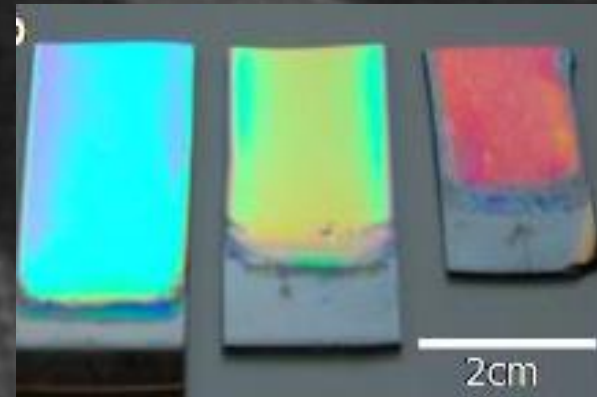
Programmable Materials

C. B. Contreras, O. Azzaroni, J. Penelas,
E. D. Martínez, P. C. Angelomé



Responsive Photonic Crystals

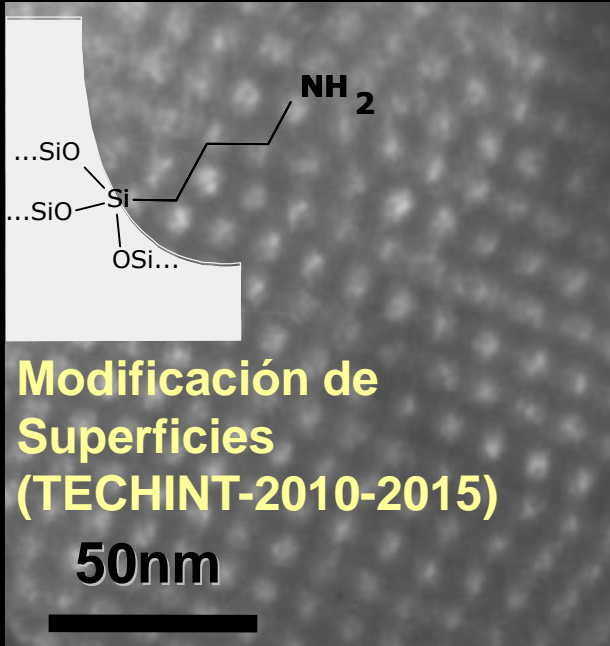
M. C. Fuertes, H. Miguez, M. E. Calvo
M. L. Martínez-Ricci



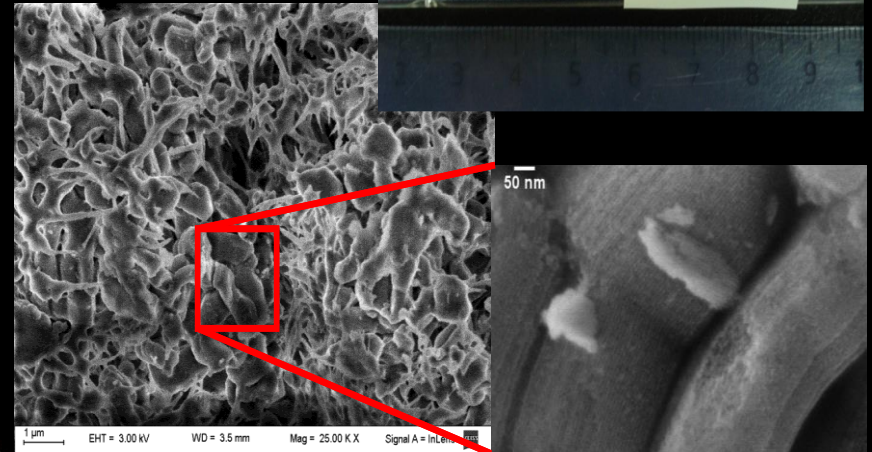
Enzymes@Mesopores

M. Bellino

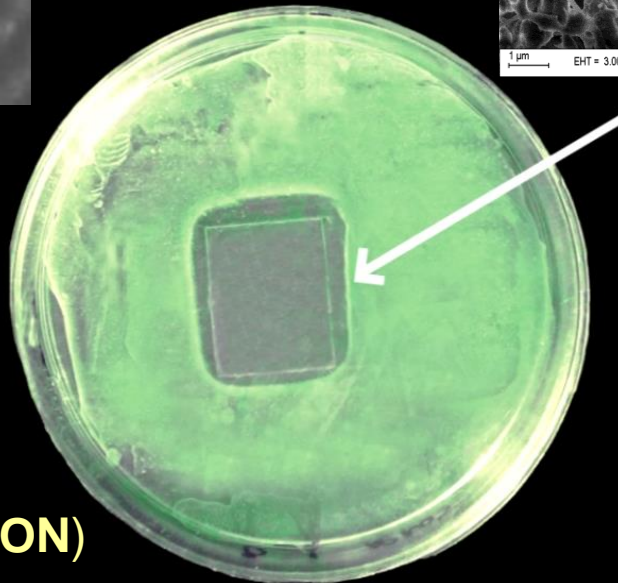
Nano-productos made in Argentina



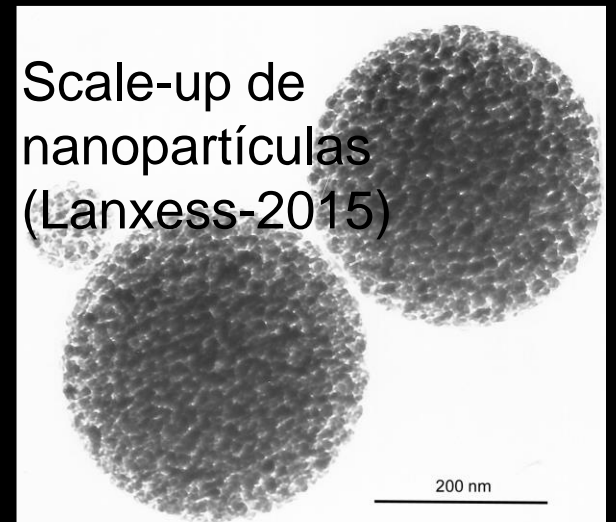
Adsorbentes para medio ambiente (Lanxess-2013)



Superficies bactericidas (Premio INNOVAR 2016, Empretecno 2017-HYBRIDON)



Scale-up de nanopartículas (Lanxess-2015)



Socios industriales



Y-TEC
YPF TECNOLOGÍA

Proyecto PDS
Fotocatálisis
UNSAM/CNEA/
UNMdP



Proyecto PDS
Síntesis NP
UNSAM/CNEA



LANXESS
Energizing Chemistry

Tesis (FONARSEC)
NP funcionales
UNSAM/CNEA/UBA



Tenaris

Tesis UNSAM
Tesina IT UNSAM
Recubrimientos
funcionales



ADOX

EMPRETECNO 2016
Antibacterianos
UNSAM/CNEA/UBA

Caso 1:

Modificación superficial de materiales

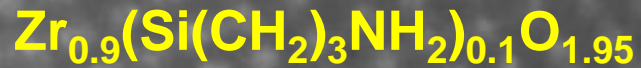
TENARIS (2007-2010)

Tesis de A. Calvo (hoy en Y-TEC)

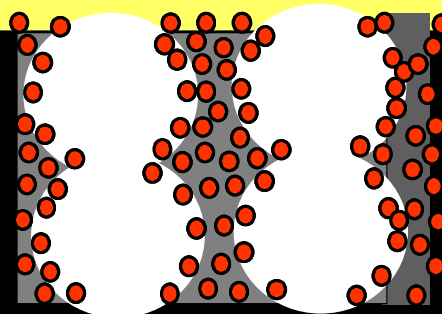
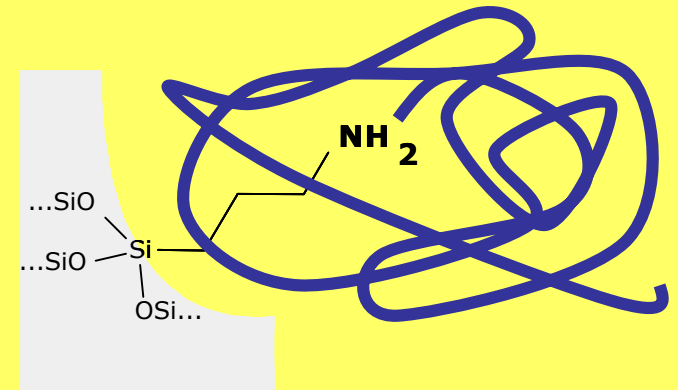
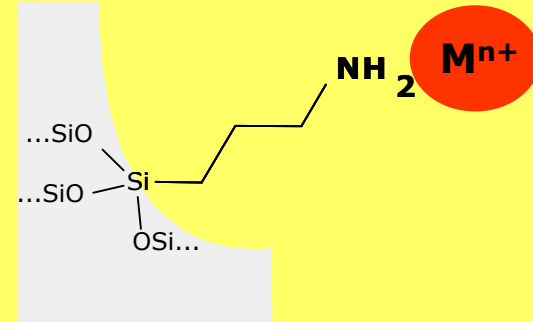
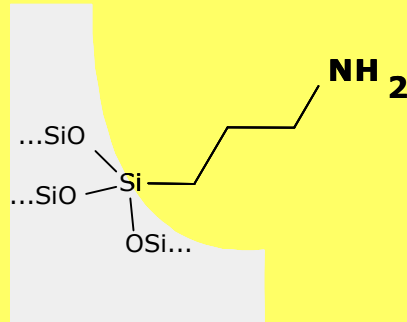
LANXESS (2008-2015)

Tesis de V. Lombardo (hoy en CNEA)
y J. Penelas (UNSAM)

Rol de los grupos funcionales de superficie



50nm



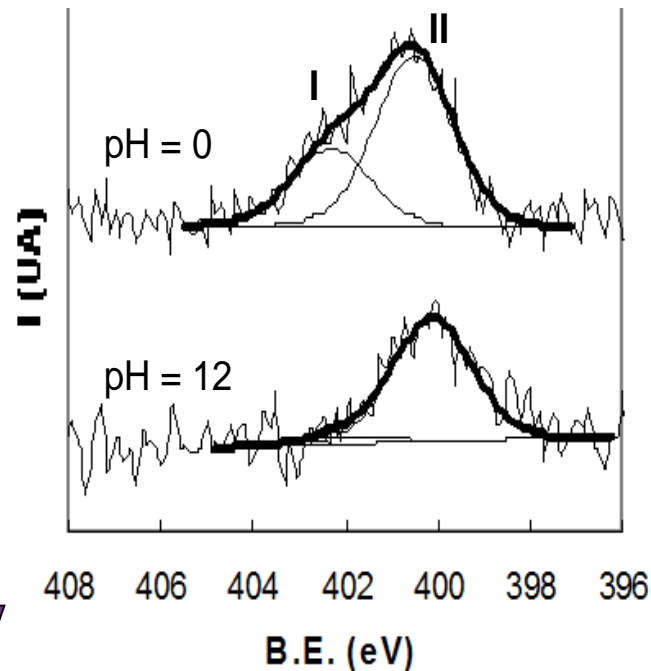
Interacciones molécula-pared
Disponibilidad de funciones

A. Calvo et al. *Chem. Mater.* **2008**, *Microp. Mesop. Mater.* **2009**
V. Lombardo et al. *J. Hazard. Mater.* **2012**

Cambios en grupos $-\text{NH}_4^+$

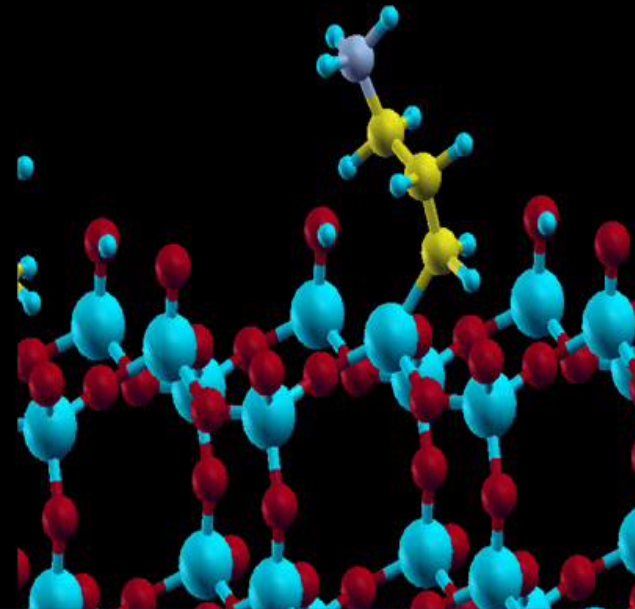
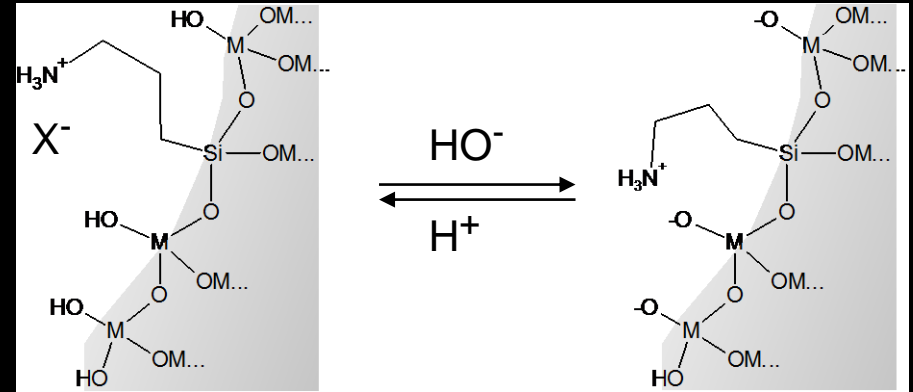
pH

XPS-Zr-amino (20%- NH_2)
Co-condensación

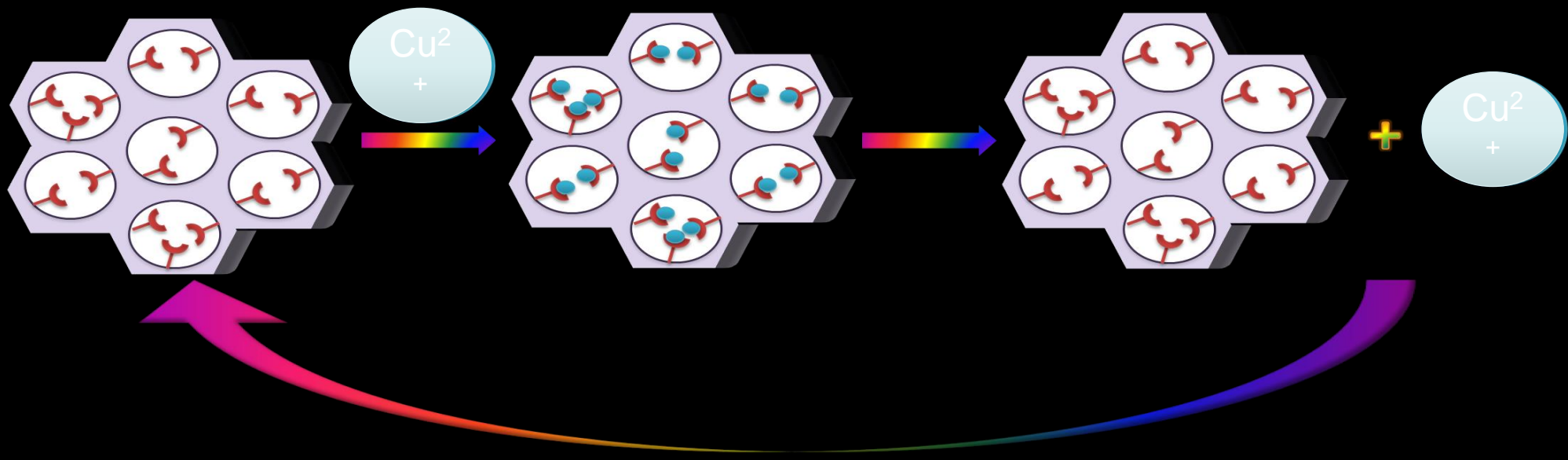


N 1s XPS

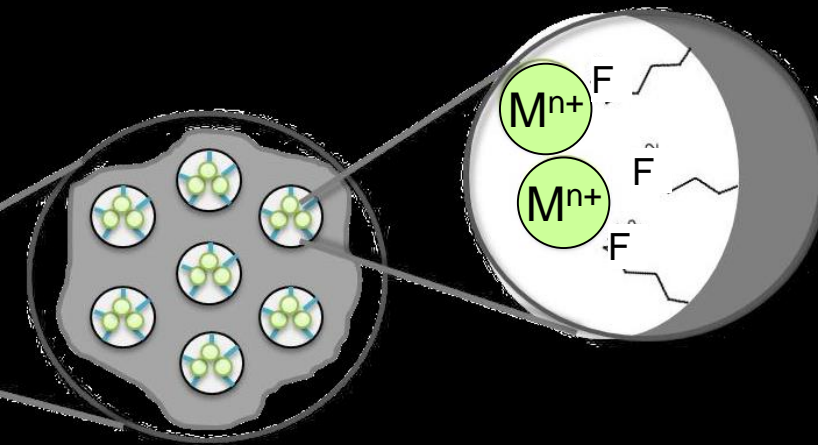
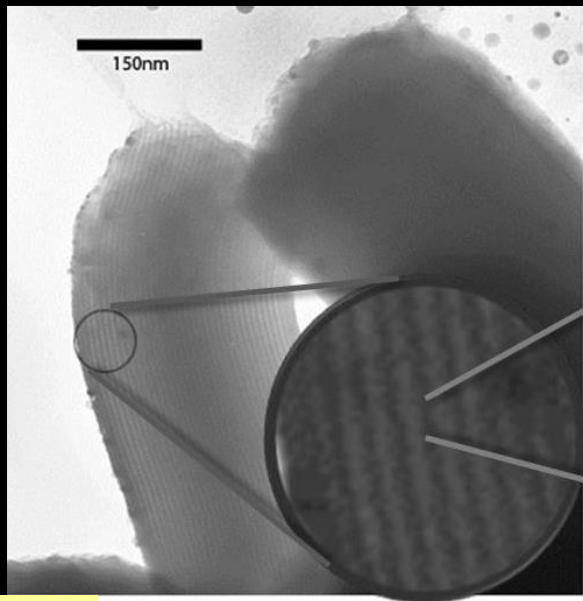
- I - NH_3^+ : 401 eV (amonio libre)
- II - NH_2 : 403 eV (amino libre y atrapado)



Colaboración F. Williams (TENARIS)
y D. Scherlis (FCEN-UBA)

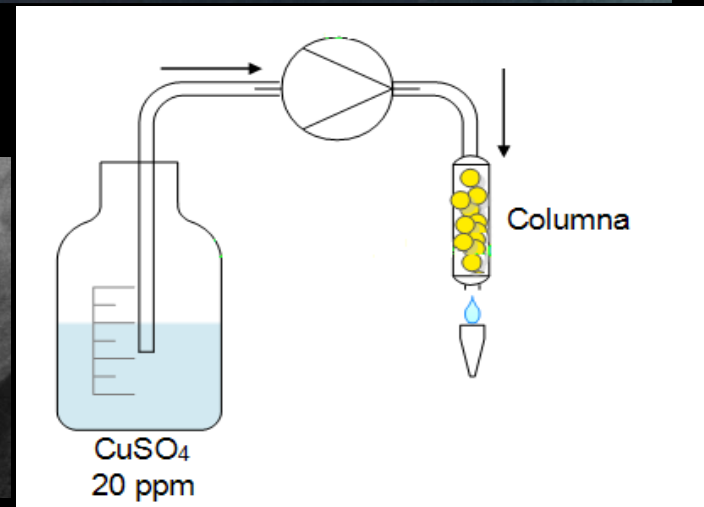
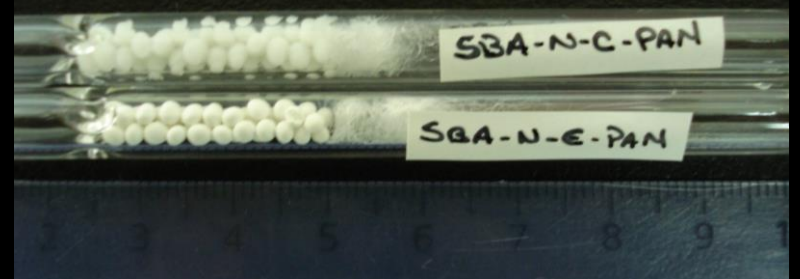
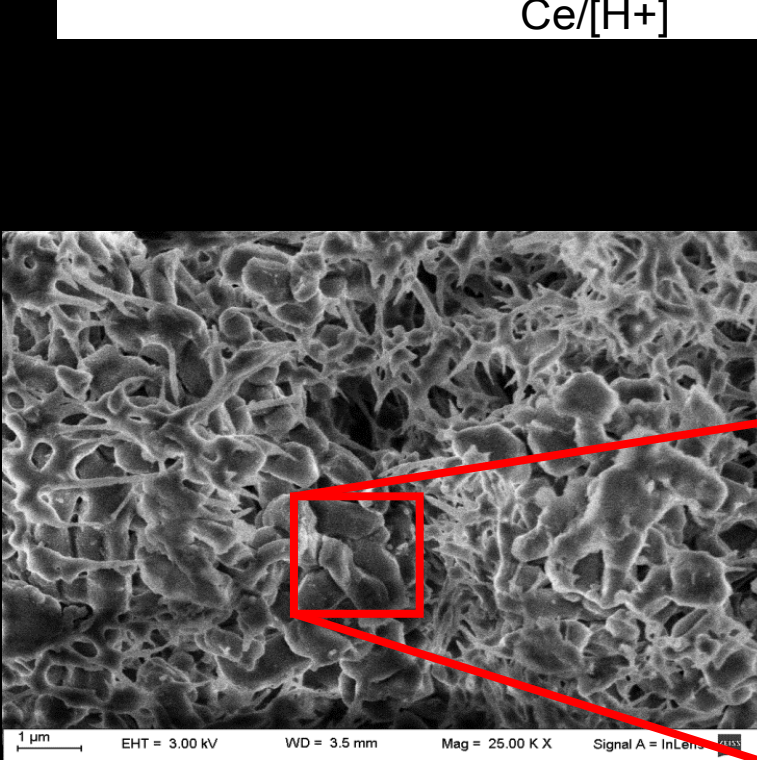
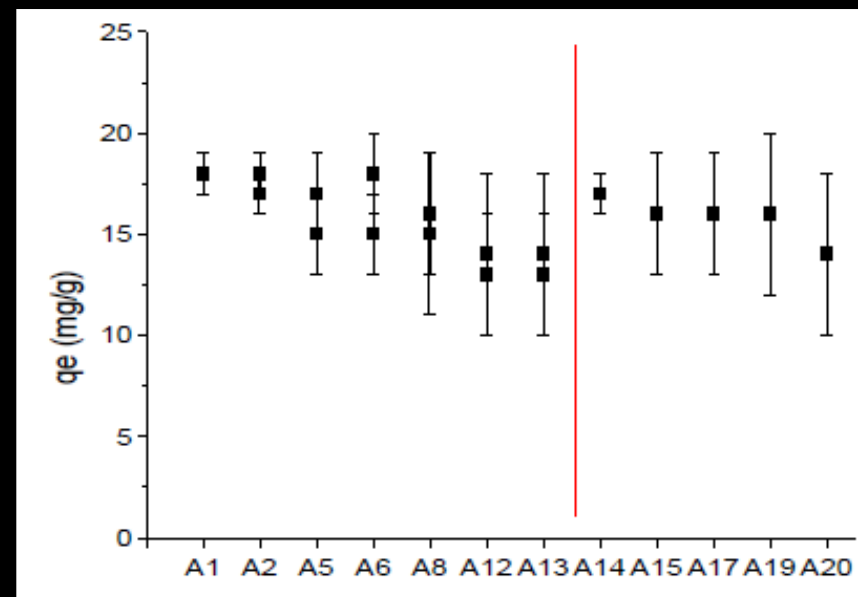
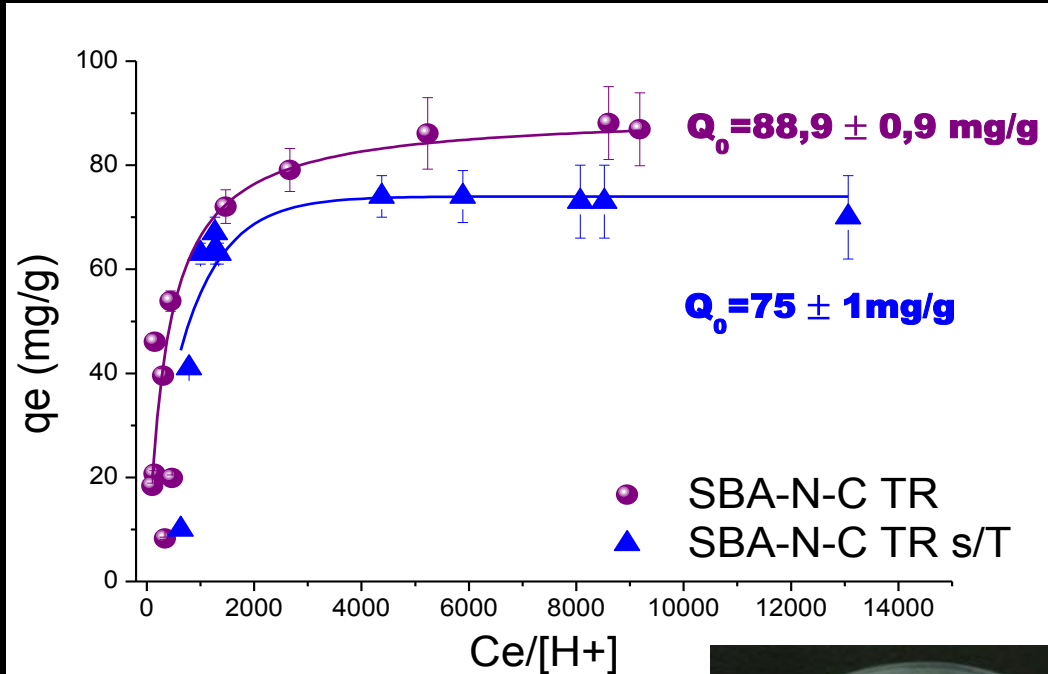


Adsorción- recuperación de metales pesados

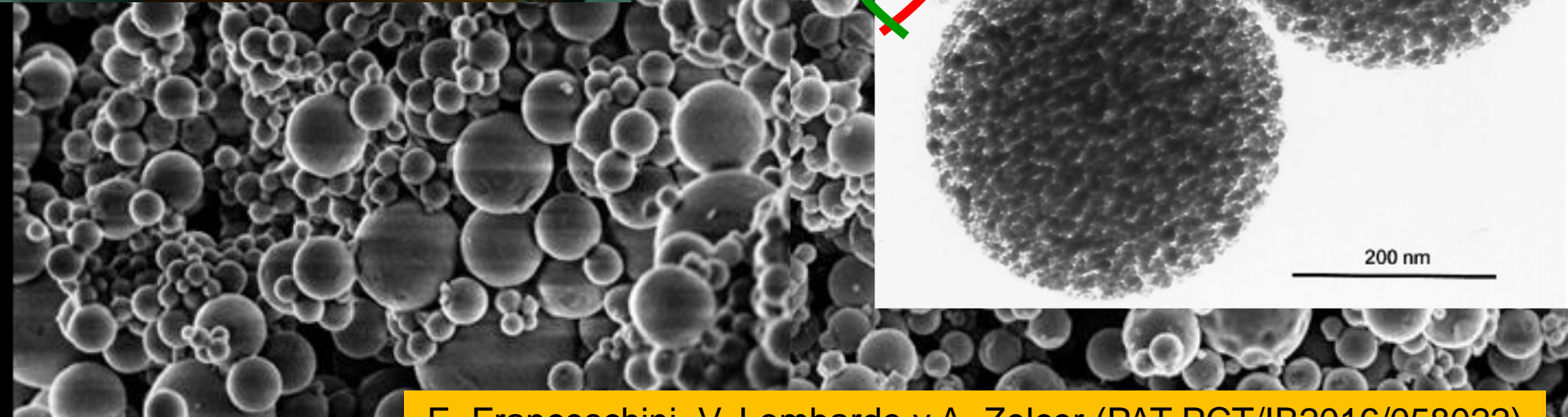
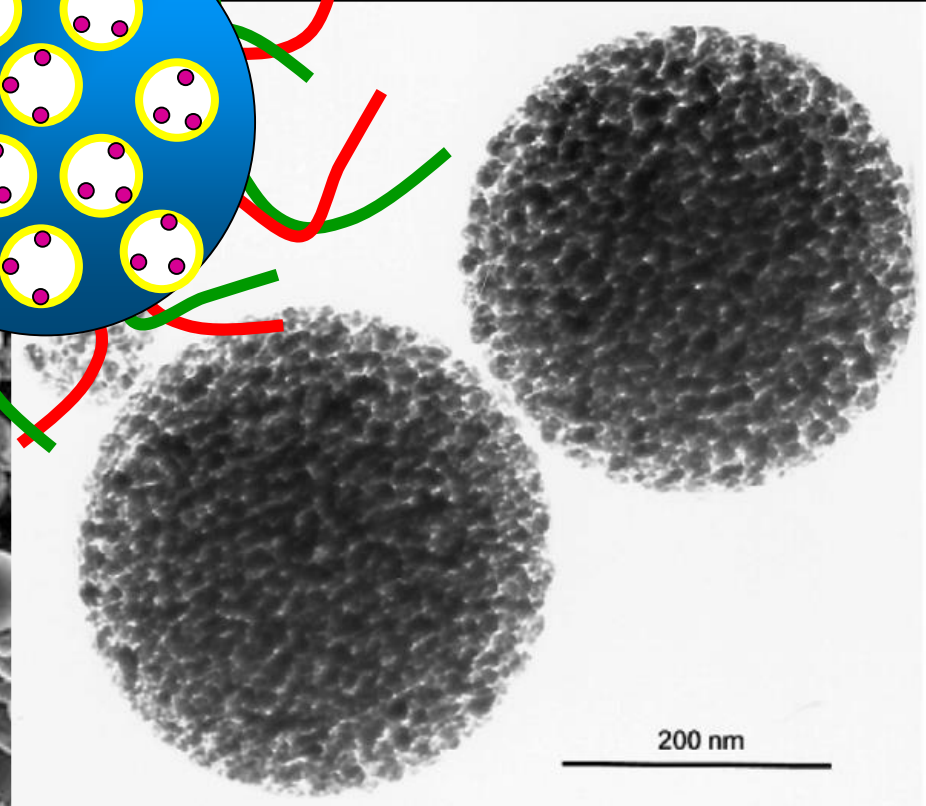
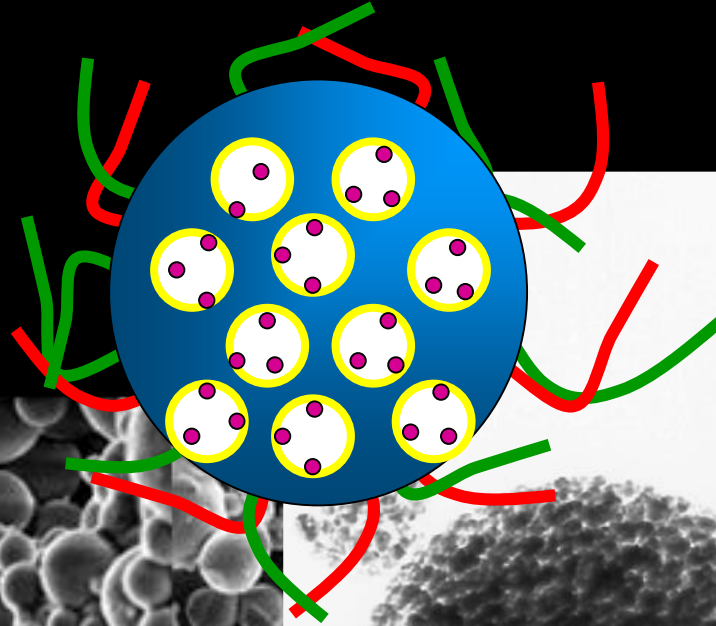


Tesis M. V. Lombardo (UNSAM)
Co-Financiada por Lanxess

M. V. Lombardo et al, *J Hazard. Mater.*, 2012



Escalado 1



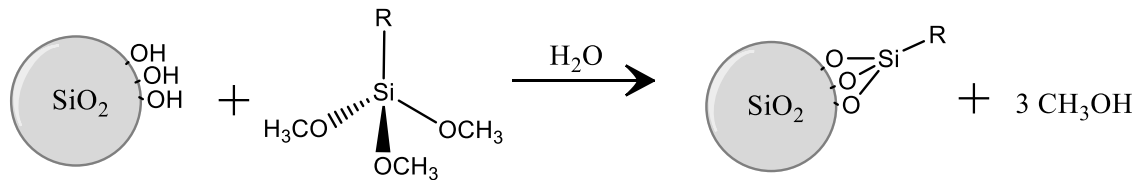
2015-2016

- Nanopartículas modificadas en superficie (LANXESS)
- Nano-adhesivos (TENARIS)

Modificación de Superficie de óxidos con silanos

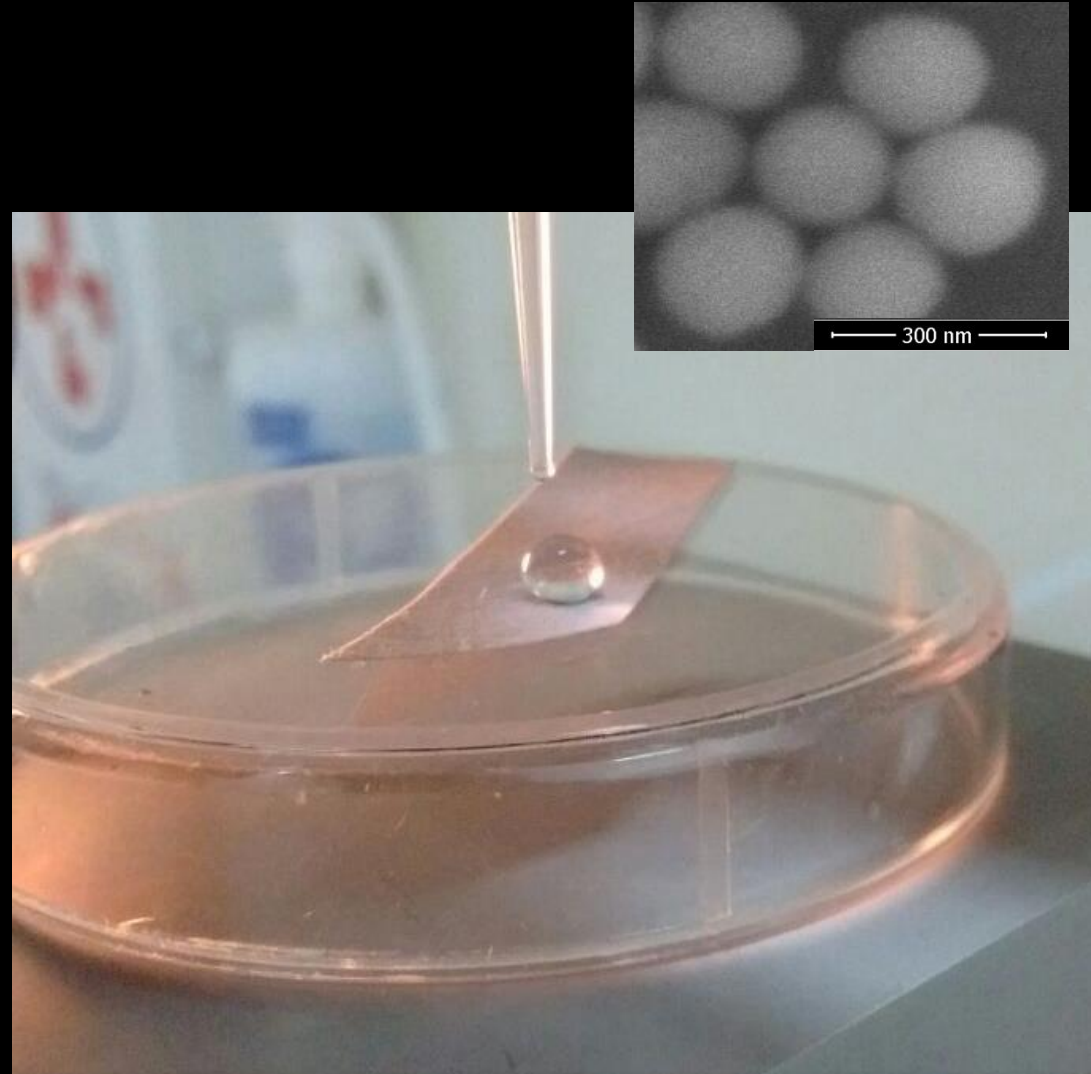
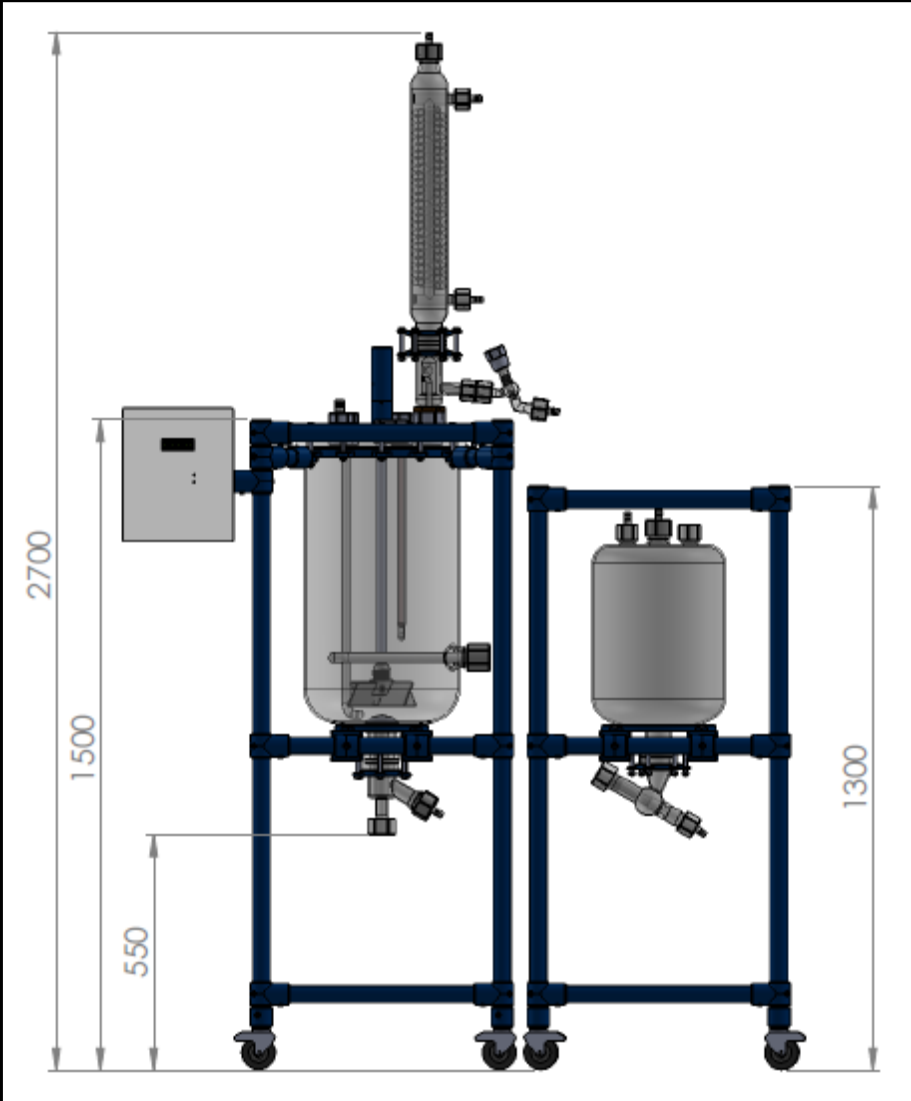
Pase a planta piloto = cambio de métodos

Química + ingeniería



Tiempos institucionales

Escalado 2

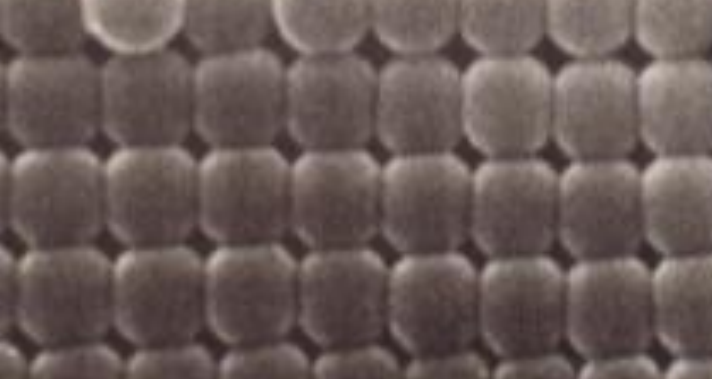


Caso 2

Cristales fotónicos
Sensores ópticos nanoporosos

Colaboración QnM-CSIC Sevilla
(desde 2006)

Tesis M. C. Fuertes (CNEA) y N.
López-Abdala (UNSAM)
Postdoc M. L. Martínez-Ricci, D.
Ceratti y D. Onna
Patentes ES y WO



Multicapas: Cristales fotónicos unidimensionales

Modulación periódica del índice de refracción al intercalar films mesoporosos de SiO_2 y TiO_2 (30-300 nm de espesor)

FE-SEM

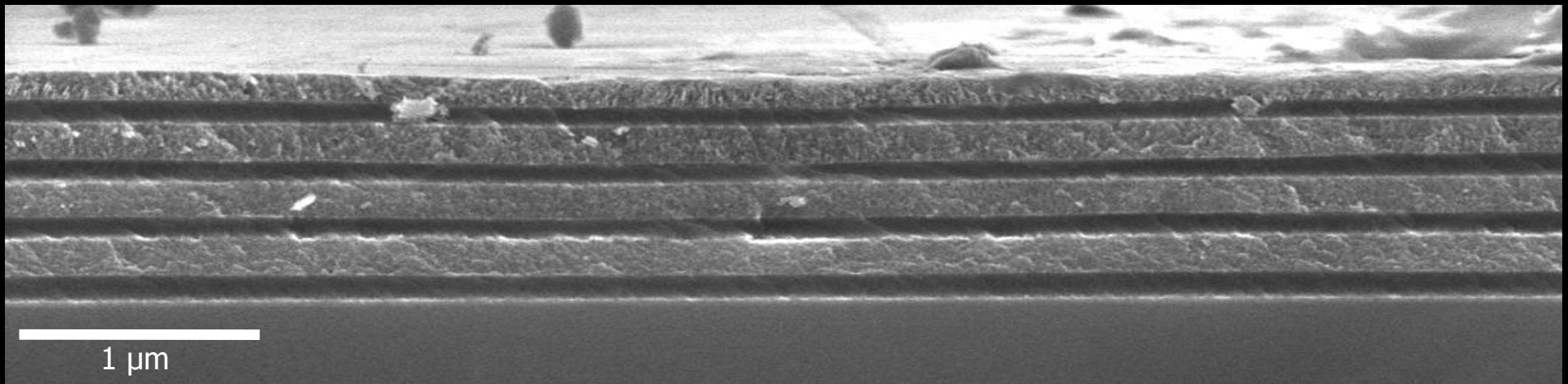
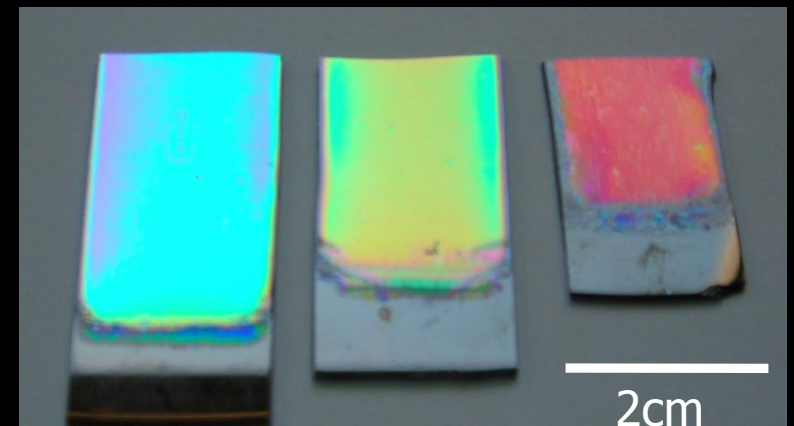


Foto: M. C. Marchi (CMA)

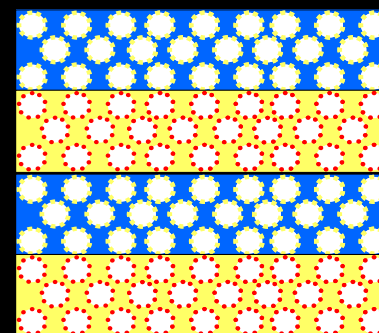
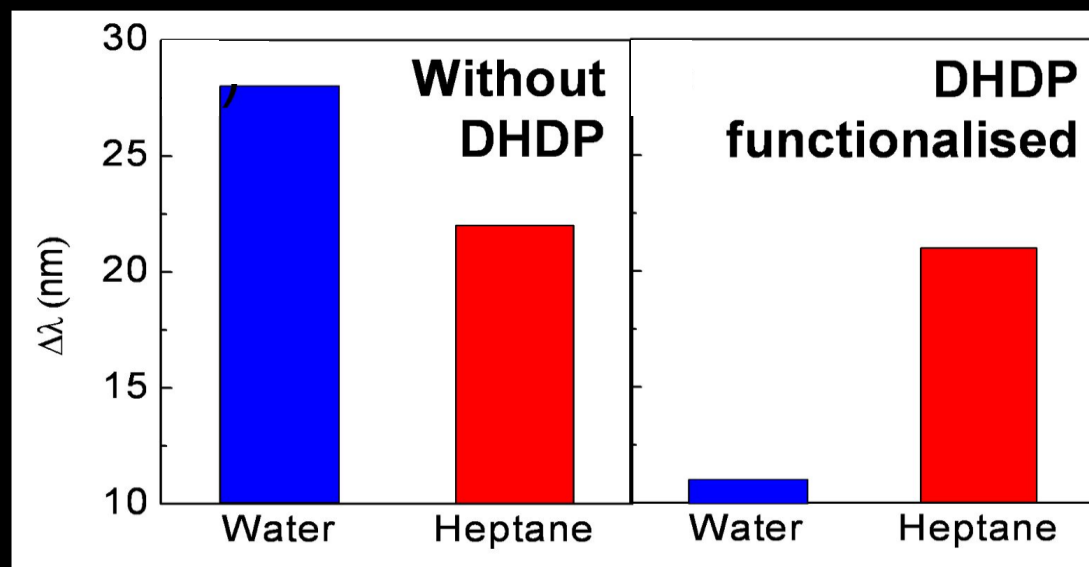
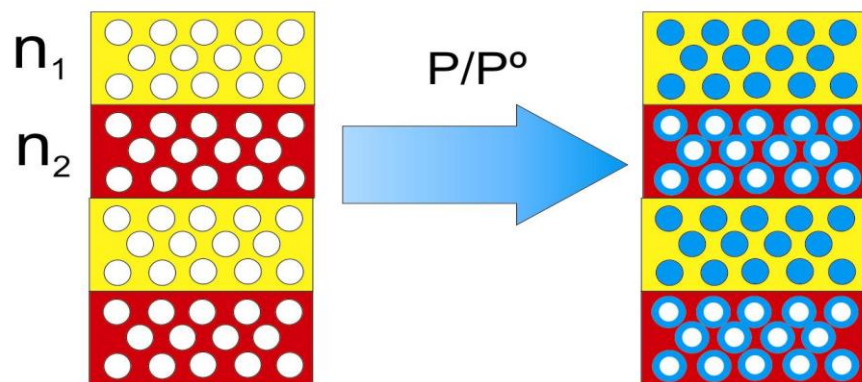
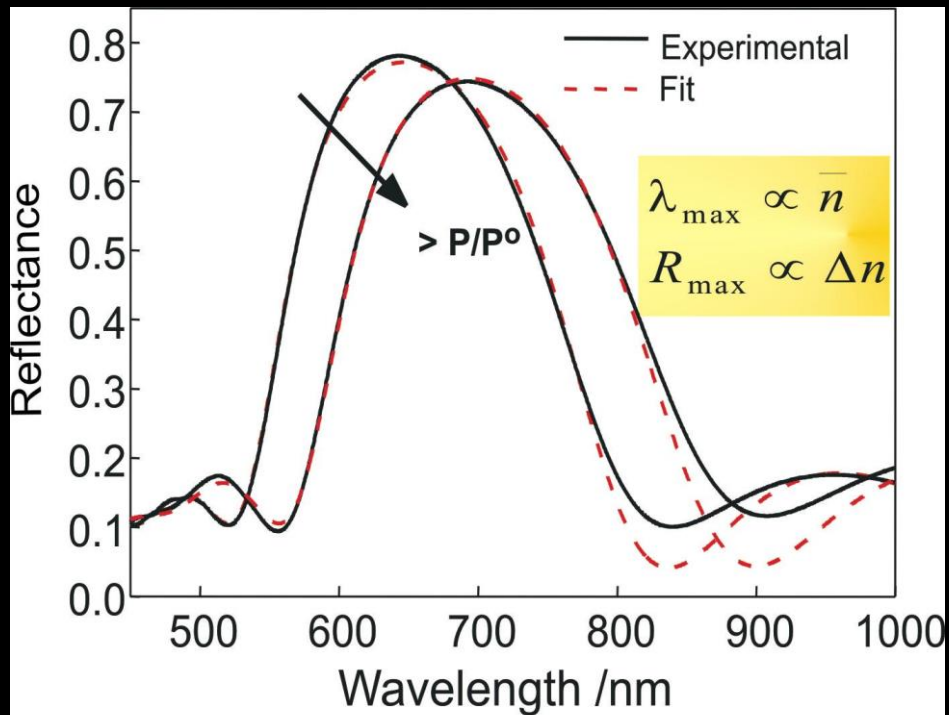
- ✓ *Color estructural*
- ✓ Films porosos, interacción con solventes, infiltración con metales...

Fuertes *et al*, *Adv. Funct. Mater.* 2007

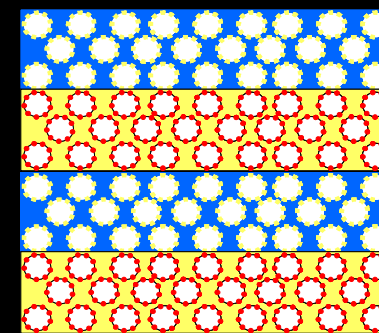
Patente **ES200602405 WO 2008/034932**



Respuesta óptica reversible y selectiva



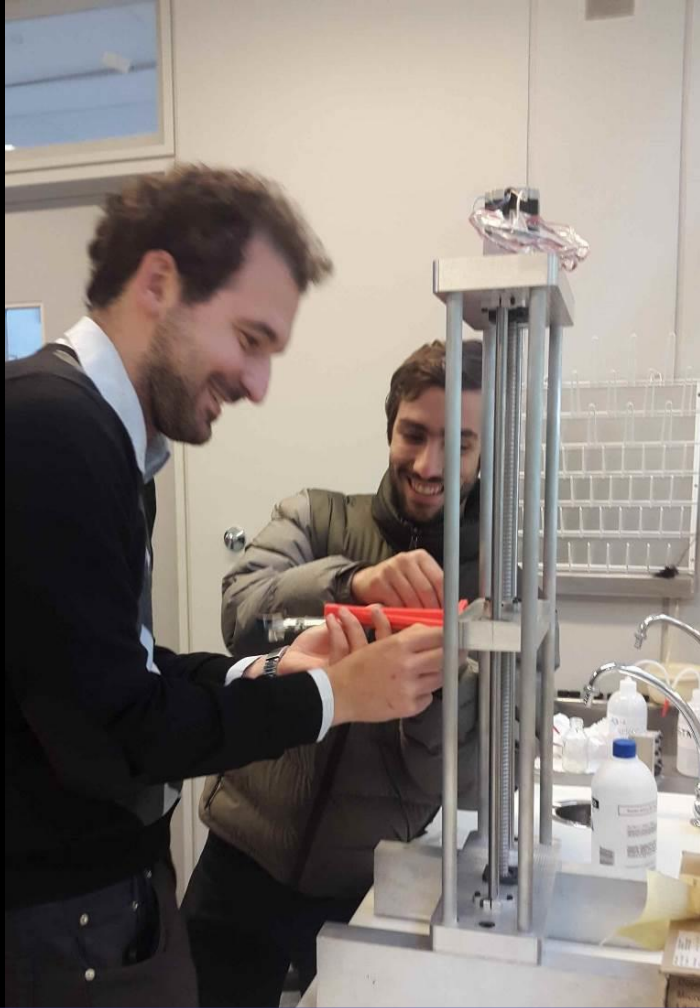
Sin funcionalizar



Funcionalizada

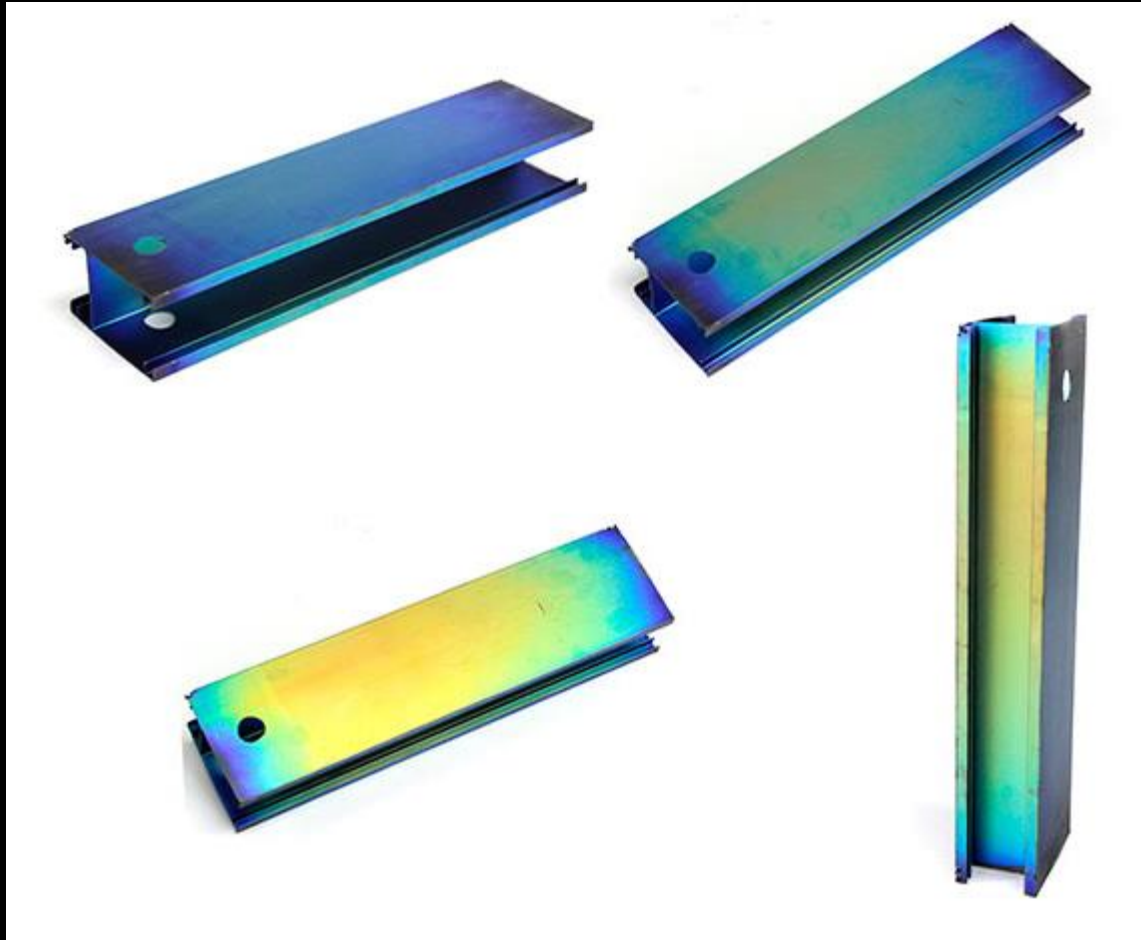
Fuertes et al. *J. Phys. Chem. C*, 2008
Míguez, et al., patent ES200602405
WO 2008/034932

Escalando el color



D. Ceratti y N. López-Abdala
Cristales fotónicos para protección de vinos y perfumes

Metales con color estructural



E. J. Calvo, M. L. Martínez-Ricci, F. Ojeda y L. Missoni *PAT*, 2015
Empresa: Laring, SA (FONARSEC FSNANO 007)

Caso 3

Recubrimientos Antibacterianos

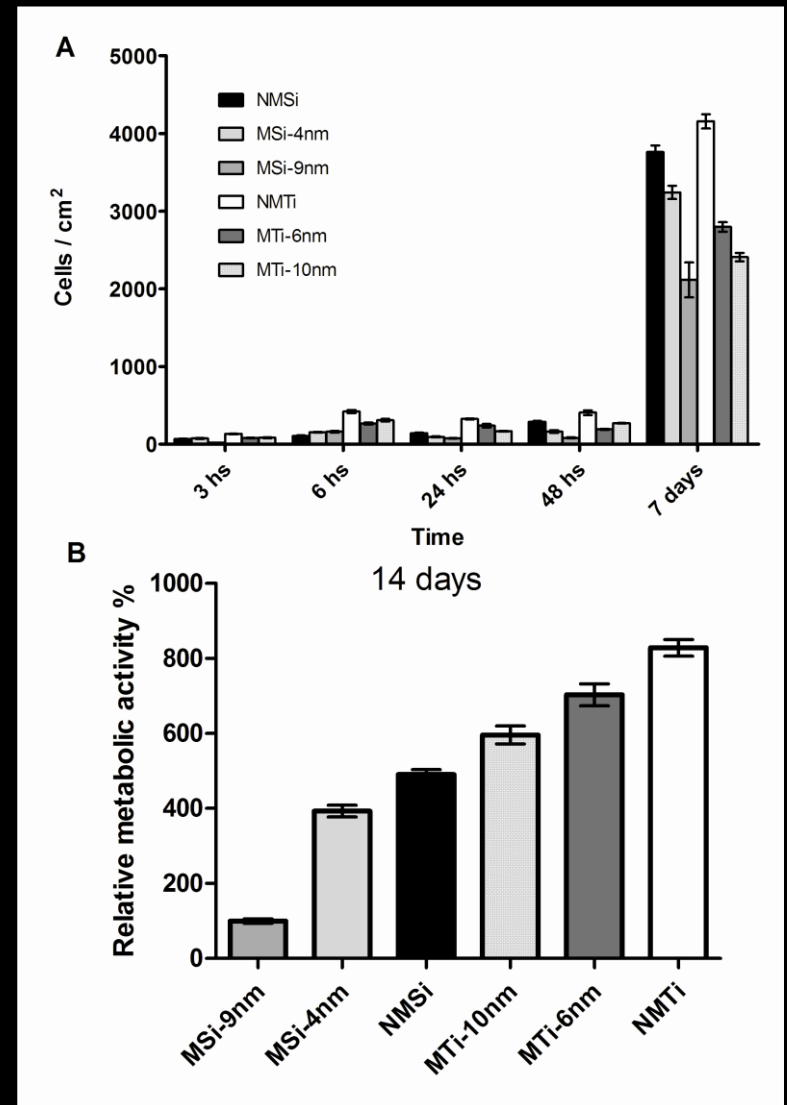
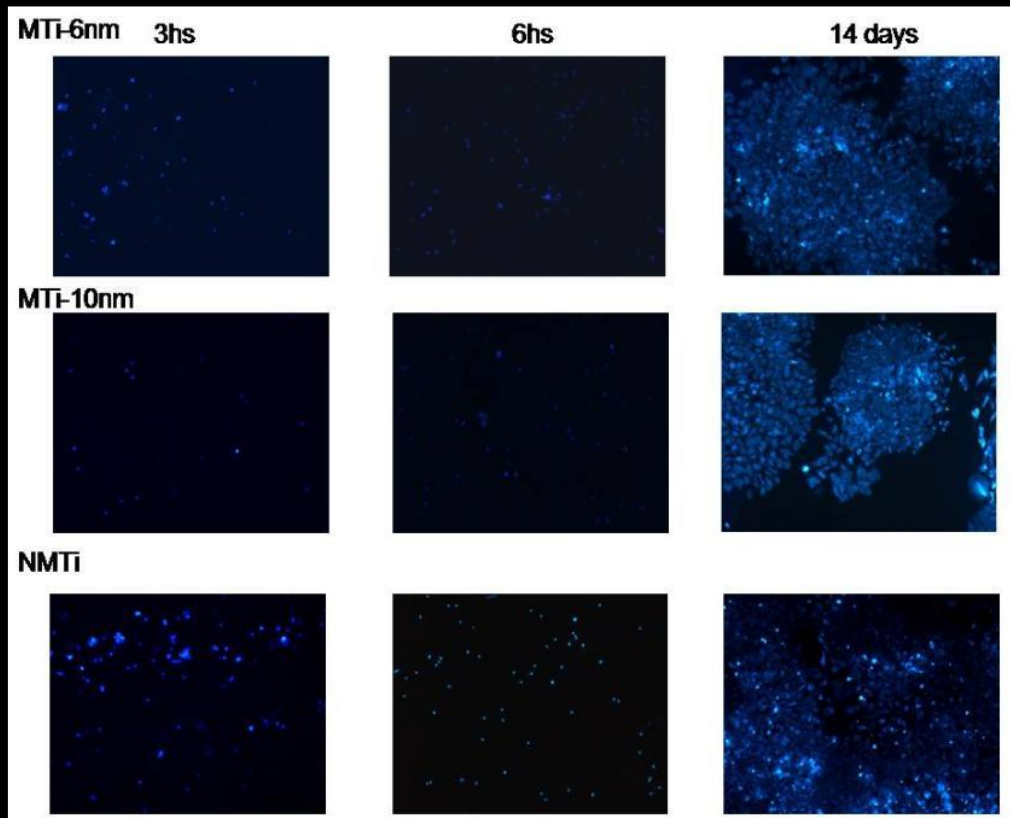
Colaboración CNEA-UNSAM-UBA
(desde 2010)

M. G. Bellino y P Catalano (CNEA)

M. Desimone (FFyB-UBA)

Patentes AR-Premio INNOVAR 2016

Andamios Celulares Nanoporosos



Crecimiento de células en dióxido de titanio mesoporoso

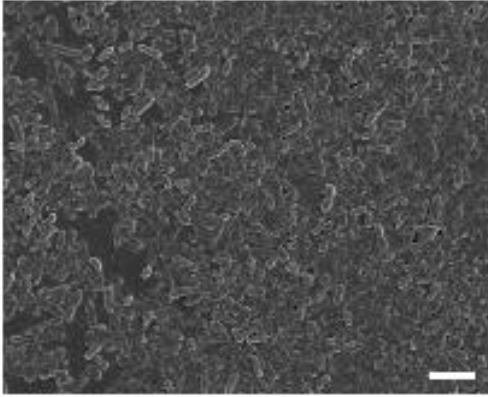
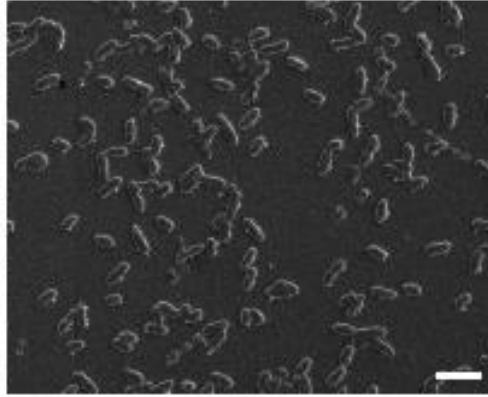
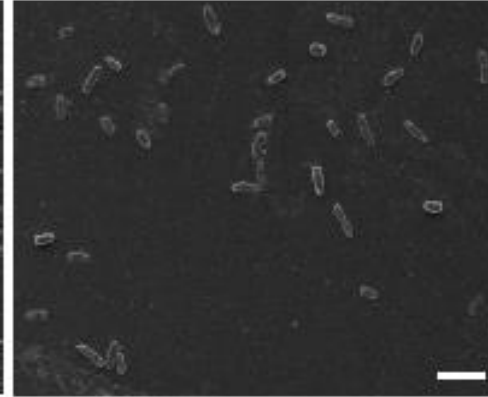
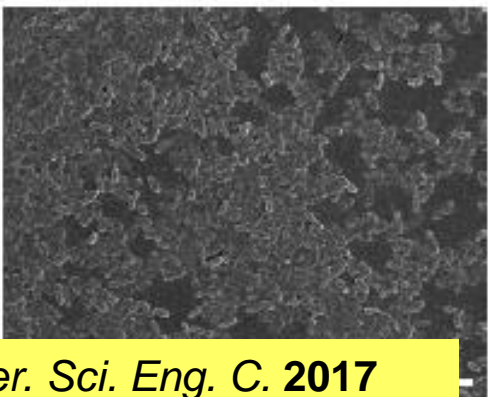
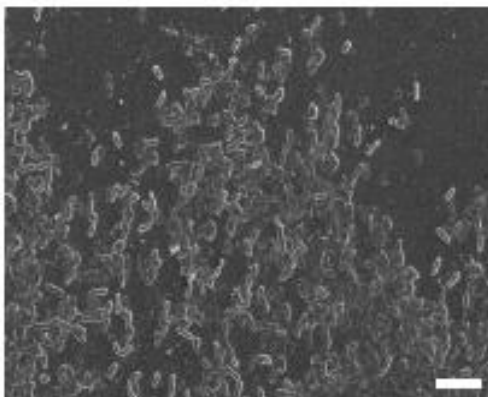
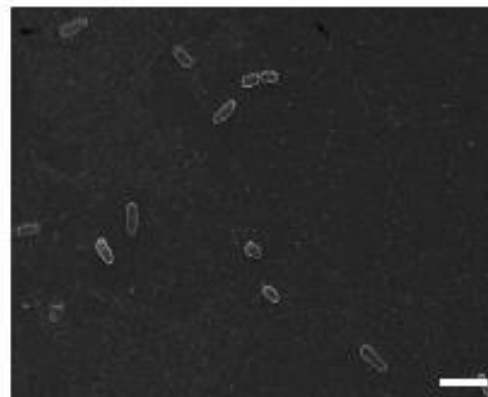
Textura en nanoescala + esqueleto inorgánico

Influyen en adhesión y proliferación de osteoblastos

Hidrofilicidad y tamaño de poro

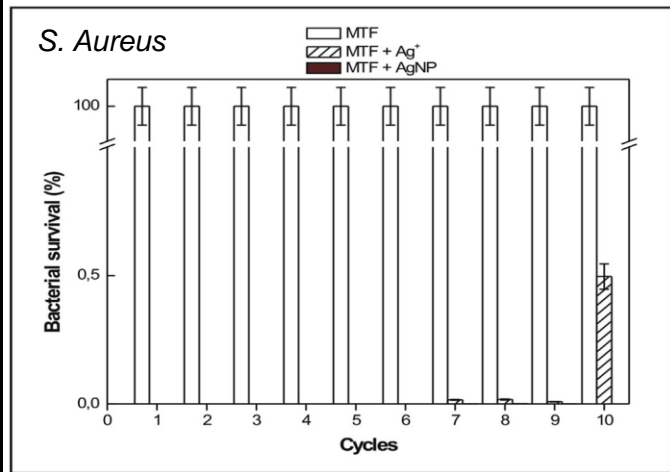
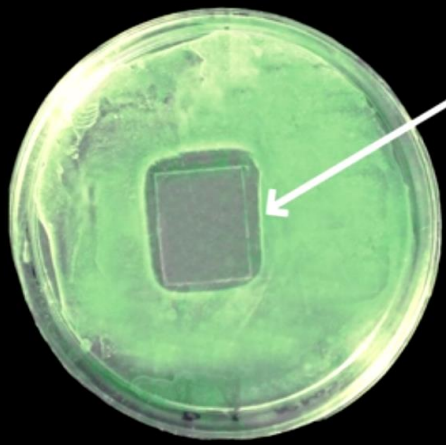
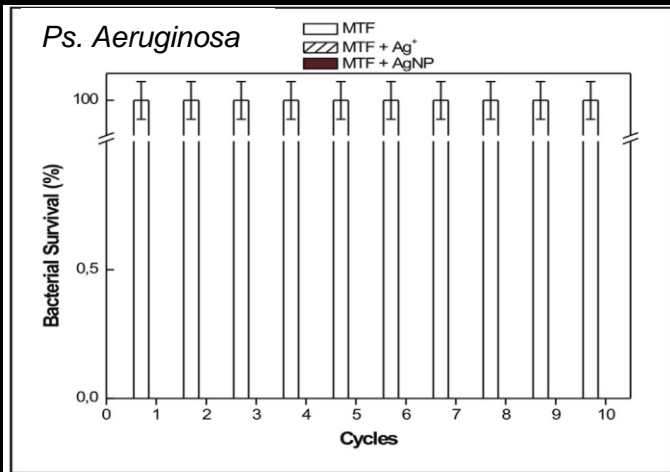
Bellino et al, *Biomater. Sci.*, 2013

Efecto Antibiofilm

Biofilm type	Film type		
	NMS	MS-4	MS-9
Submerged			
ALI			

M. Pezzoni et al, *Mater. Sci. Eng. C.* **2017**
P. Catalano et al, *AR P20160101235*, **2016**
PCT/IB2017/052537

Superficies antibacterianas



Del Laboratorio al Producto

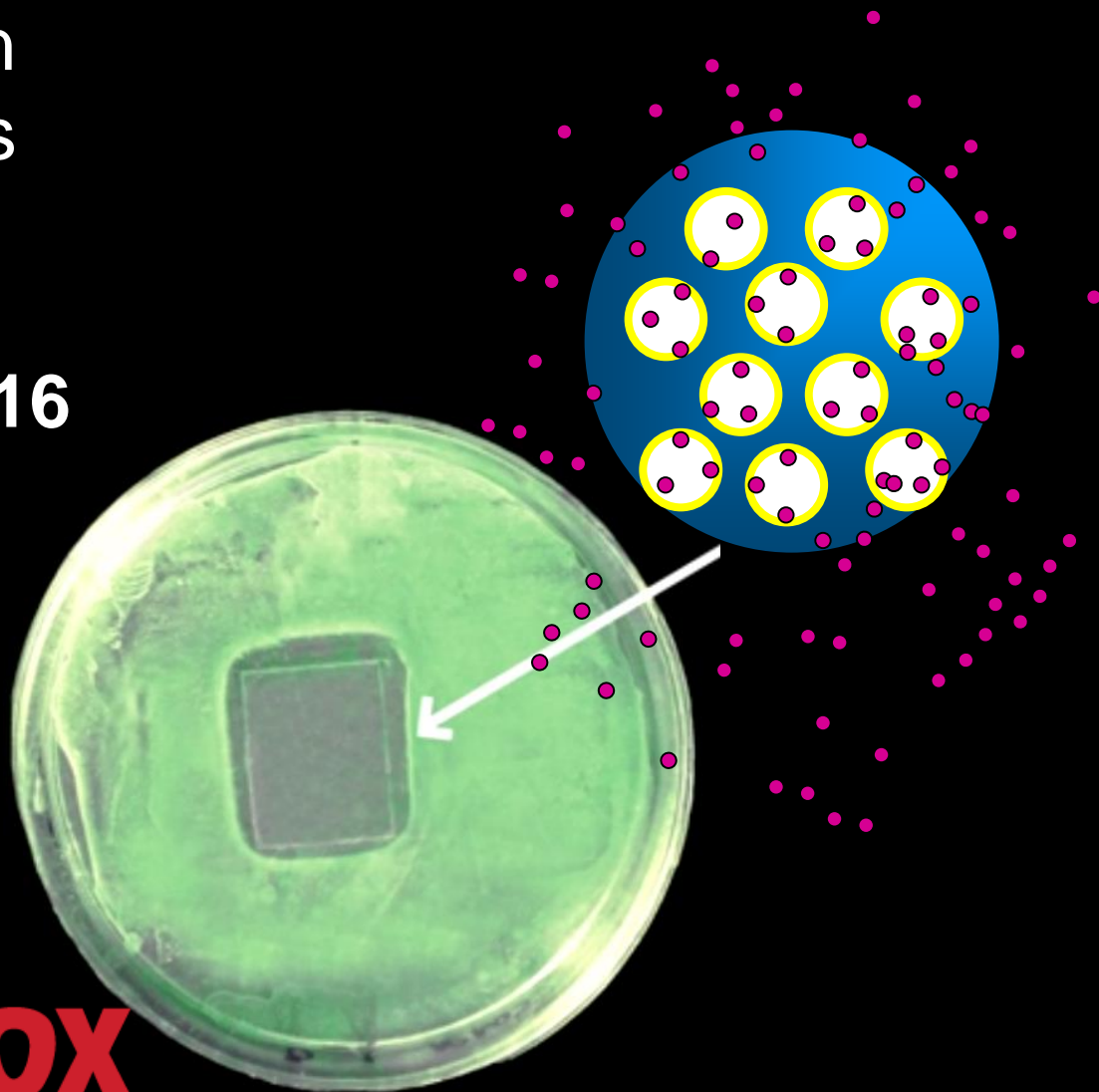
Materiales nanoporosos con propiedades antibacterianas

CNEA-UBA-UNSAM

Gran Premio INNOVAR 2016

EMPRETECNO 2017

Hybridon



Generación de RRHH



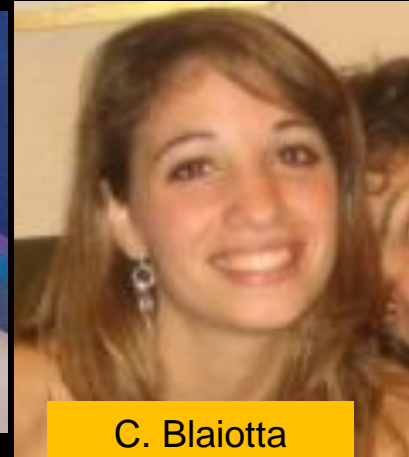
M. Alderete-Hybridon



B. Scalise-Sokotherm



A. Calvo-Y-TEC



C. Blaiotta
ADOX/Hybridon



J. Galdorporpora
Hybridon



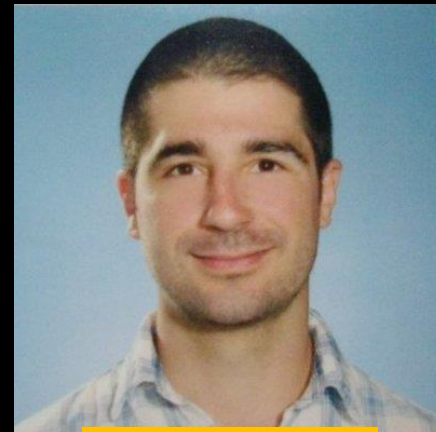
Nico López Abdala
TENARIS



R. Medina-YPF



V. Oestreicher
TECSAN



F. Ojeda-Laring



J. Penelas-Lanxess



Podemos resolver los
problemas más relevantes
de la Humanidad

Tenemos nuevas
herramientas que permiten
comprender y crear

Resolver problemas
prácticos permite generar
nueva ciencia interesante

George Whitesides, 2015

Emprender en NT en ARG

Debemos dejar de pensar low cost

- **Ciencia de calidad para tecno de punta**
- **Sistema eficiente (\$, t)**
- **ECOSISTEMA (CTI)**
- **Coordinación de Actores**
- **Generación de RRHH**
- **CULTURA**
- **Interacción Lab-Empresa**
- **Ambición**





UNSAM

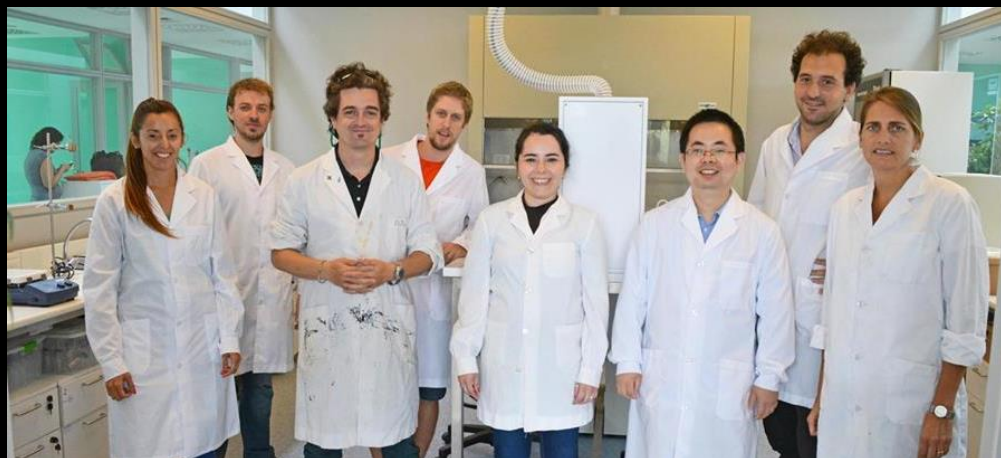
Gracias !

Colaboraciones

S. A. Bilmes, M. Jobbágy, D. Scherlis, M. Tagliazucchi, F. Williams (UBA)
 O. Azzaroni, F. Requejo (La Plata)
 A. Fainstein - H. Troiani (Bariloche)
 C. Sanchez. C. Boissière (Paris) – P. Innocenzi (Alghero) – M. Takahashi, Y. Tokudome (Osaka), M: Müller, P. Vana (Göttingen) - H. Míguez (Sevilla)
 H. Amenitsch (Elettra)
 L. Liz-Marzán, S. Moya (Donosti)
 – L. D. Carlos (Aveiro) – I. Szleifer (Chicago)

\$ - Funding - \$

CNEA, CONICET, UBA, MinCyT, Horizon 2020, Fund. Antorchas, MAE, IT/UNSAM, LNLS, Fundación Bunge y Born, TENARIS, TECSAN, Lanxess, Y-TEC



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<https://www.facebook.com/insunsam/>

