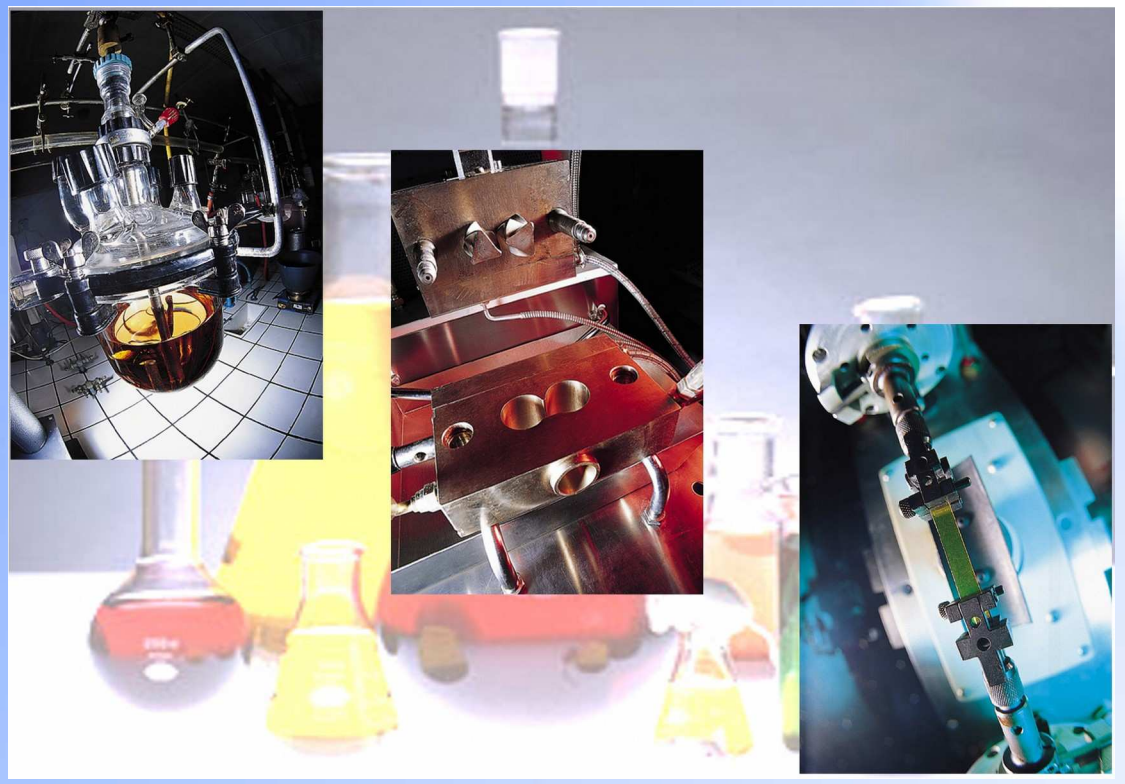
UMR 5223 Polymer Materials Engineering Lab.



Scientific Area: Polymers
From Chemistry to « Object »

UNIVERSITÉ DE LYON
cnrs
UNIVERSITÉ JEAN MONNET SAINT-ÉTIENNE
INSA
imp

SCIENTIFIC AREA OF EXPERTISE

Polymers, from Chemistry to « Object » (through its properties and functions)

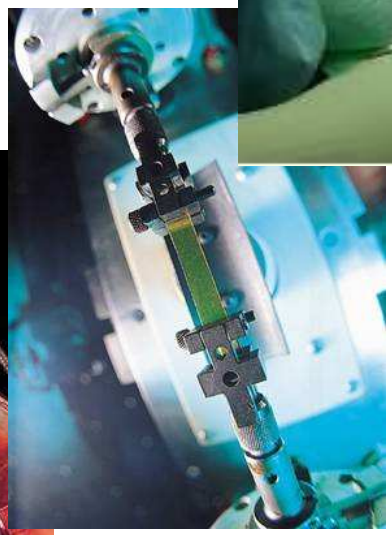
In 4 core scientific areas of expertise:

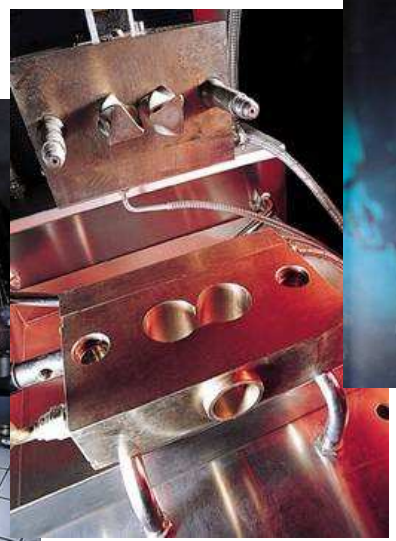
Chemistry and Macromolecular Chemistry

Polymer Rheology and Processes

Polymer Physics and Functional Properties

Polymer at the Interface with Life Sciences



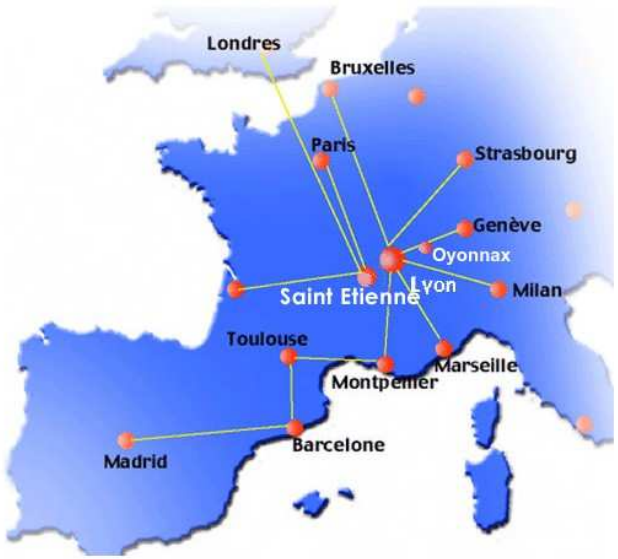


STATUS AND LOCATION

CNRS Joined Research Team UMR5223

Member of the Community of University Lyon-St Etienne

Head: *Prof. C. CARROT*



INSA Lyon, *Villeurbanne and Oyonnax*

Prof. Etienne FLEURY

etienne.fleury@insa-lyon.fr

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Prof. Thierry DELAIR

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Saint-Etienne

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majeste@univ-st-etienne.fr

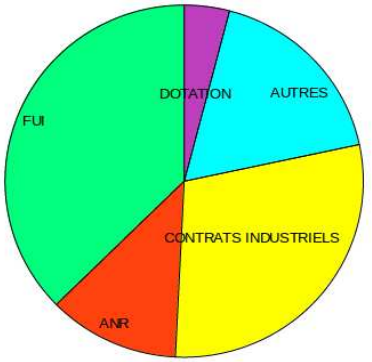
htpp://www.imp.cnrs.fr

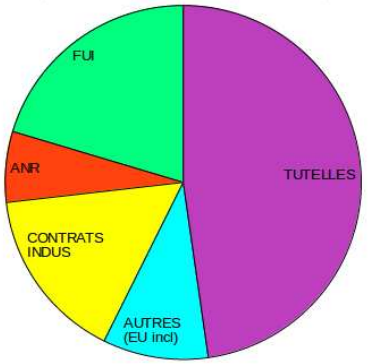
IN A FEW FIGURES

226 Members : Senior scientists : 56, Technical Staff : 31, PhD or postdoc: 125.

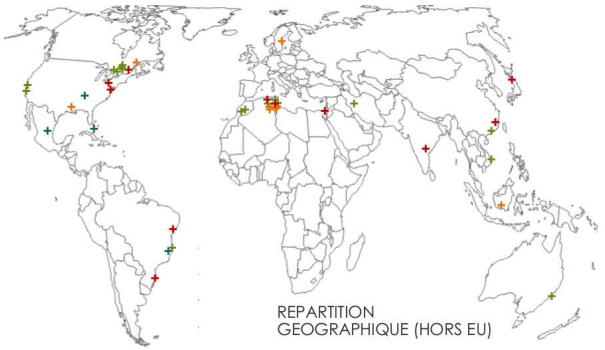
86 scientific papers, **97** oral presentations (**22** invited) in 2017

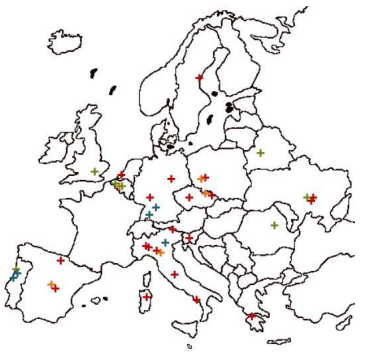
5.6M€ fundings and contracts (2017)
11.3 M€ budget including salaries





94 international partnerships (2016)





ORGANIZATION

CODIR

COMITE H&S

CONSEIL D'UNITE

CONSEIL SCIENTIFIQUE

EXTERNAL BOARD

DIRECTION D'UNITE
C. Carrot

DIRECTION-ADJOINTE SITE UCB
T. Delair, E.Espuche*

DIRECTION-ADJOINTE SITE INSA
E. Fleury, J.Duchet*

DIRECTION-DELEGUEE SITE UJM
J.C. Majesté*

*Directeur par délégation (établissement)

DIRECTION ADMINISTRATIVE
S. Novat

WEBMASTER

SECRETARIATS DE SITES
I. Polo, N. Yacoub, A. Mercier

GESTION DE PROJETS
S. Baudu

FONCTIONS SUPPORT

FORMATION / ED
T. Delair, C. Ladavière
M.T. Charreyre, J.C Majeste

PRESTATIONS / ETUDES TECHNIQUES
R. Brunel

LABO COMMUN
HUTCHINSON

DIRECTION
V. Bounor

POLES DE COMPETENCES

P1
Chimie des Polymères Synthétiques et Naturels

ANIMATEURS
F. Becquart
E.Drockenmuller
E. Fleury

P2
Structure et Rhéologie des Polymères-Procédés et Simulation

ANIMATEURS
R. Fulchiron
A. Maazouz
J.C. Majesté

P3
Polymères et Propriétés Physiques et de Fonction

ANIMATEURS
J. Duchet
E. Espuche
F. Prochazka

P4
Matériaux Polymères à l'Interface avec les Sciences de la Vie

ANIMATEURS
M.T. Charreyre
L. David
C. Ladavière

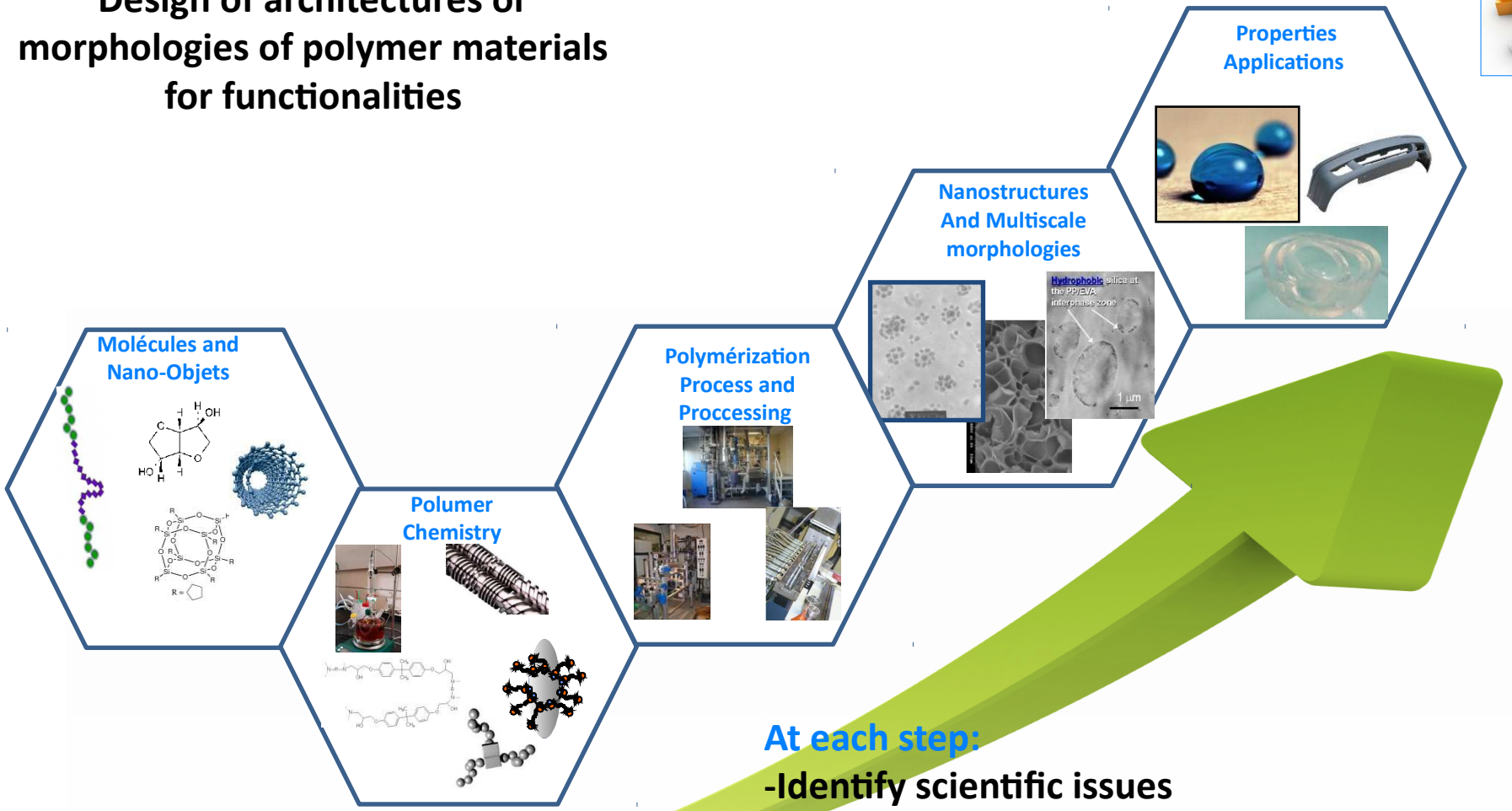
PLATEFORMES TECHNIQUES

RMN
CHROMatographie
PROCESSing
RHEOLogie
MICROscopie
REACTeurs
PHYSique
THERMique

EQUIPES DE PILOTAGE SCIENTIFIQUE / OPERATIONNELLE (23 Ingénieurs et techniciens)

SCIENTIFIC POLICY AND OBJECTIVES

Design of architectures or morphologies of polymer materials for functionalities

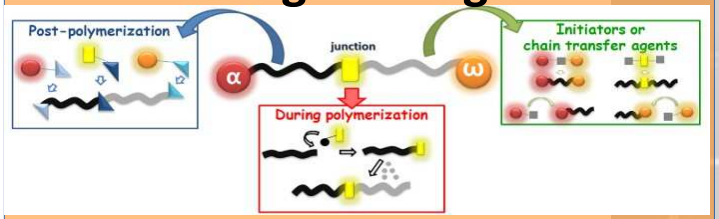


At each step:

- **-Identify scientific issues**
- **-Use a large variety of concepts and tools**
- **-Characterize accurately by coupled techniques**
- **-Modelize to predict**
- **-Question results and conclusions**
- **-Propose alternative approaches**

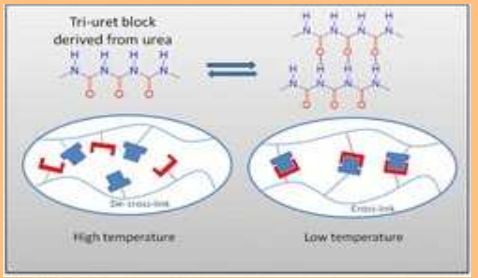
1-Polymer chemistry

Topic #1- Macromolecular Engineering



Dye-labelled polymer chains at specific sites: Synthesis by living/controlled polymerization
M.T. Charreyre *et al. Prog. Polym. Sci.* 36, 568 (2011)

*Topic #2-*Supramolecular or Dynamic Chemistry



Polyurea–Urethane Supramolecular Thermo-Reversible Networks
Y. Ni et al. *Macromolecules*, 46, 1066–1074 (2013)

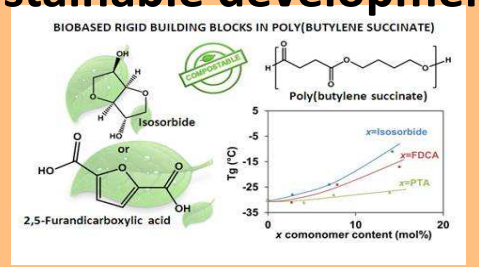
Chemistry of Polymerization

Chemical Modification of natural (polysaccharides) and oil-based polymers

Condensed Phase Reactions and Reactive extrusion

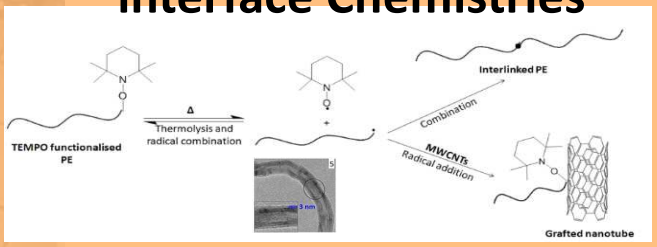
Chemical and Microstructure Analysis : NMR, Chromatography, DSC, Spectroscopy (IR, UV, Raman)

Topic #3- Chemistry & Sustainable development



Polymers from renewable 1,4:3,6-dianhydrohexitols (isosorbide, isomannide and isoidide): A review
F. Fenouillot *et al.*
Progress in Polymer Science 35, 578–622 (2010).

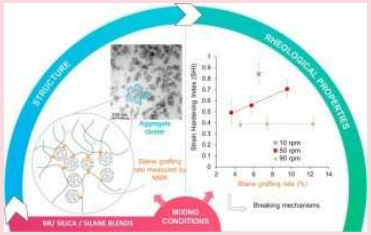
Topic #4- Surface et interface Chemistries



Nanostructured organic–inorganic hybrid films prepared by the sol–gel method from self-assemblies of PS-b-paptes-b-PS triblock copolymers.
C. Gamys et al. J. Polym. Sci.Part A: Polym. Chem. 49, 4193-4203 (2011).

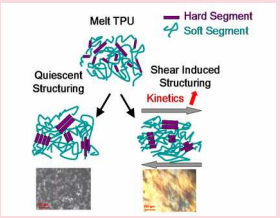
2-Polymer Structure and rheology - Process and Modelling

Topic #1- Linear viscoelasticity : (VEL) characterization in viscosimetric flows



Correlation of silane grafting density with rheological properties of silica filled rubber: Coupling of flow and temperature
M. Yrieix et al. European Polymer Journal, 94, 299-310 (2017).

*Topic #2-*Non linear VEL : organization under stress in viscosimetric flows



Composition Effects of Thermoplastic Segmented Polyurethanes on their nano-structuring kinetics with or without preshear
E. Mourier et al. Journal of Polymer Science, Part B: Polymer Physics, 49, 801-811 (2011)

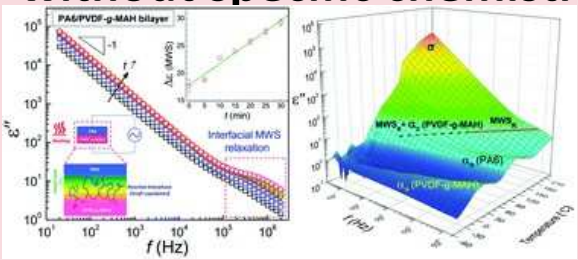
Reactive Processes (dispersed media, High T°, sol-gel, SC CO_2)

Structuration of polymers in or from the melt

Modelling of processes and mixing devices

Linear and non-linear viscoelasticity of polymer melts, gels, blends, composites.

*Topic #3-*Non viscosimetric flows (during processing) with or without specific chemistry



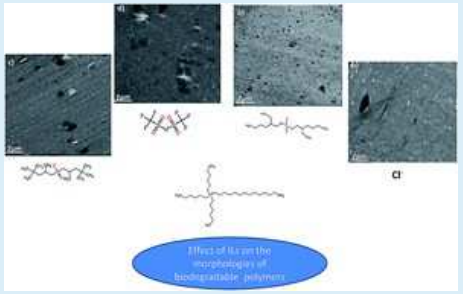
Coextrusion of multilayer structures, interfacial phenomena.
K. Lamnawar et al. Encyclopedia of Polymer Science and Technology. (2013)

Topic #4- Modelling of processing tools

Residence time distributions in a co-kneader: A chemical engineering approach.
B. Monchatre et al. Polymer Engineering and Science, 55(6), 1237-1245 (2015).

3-Physics and Functional Properties of Polymer-based Materials

Topic #1- Ionic Materials



Ionic liquids–lignin combination: an innovative way to improve mechanical behaviour and water vapour permeability of eco-designed biodegradable polymer blends.
S. Livi et al. *RSC Advances*, 5, 1989-1998 (2015).

Relationships between architectures-physical properties

Design of homogeneous or multiphased materials

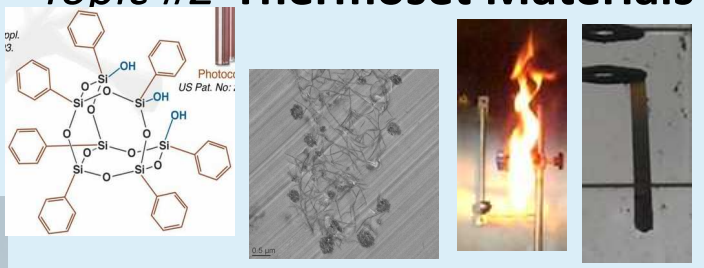
(Multi) Functional Polymers with a multi-scale structuration

Reinforcement in bulk and at surface

Segmentary Mobilities and electronic and ionic transport

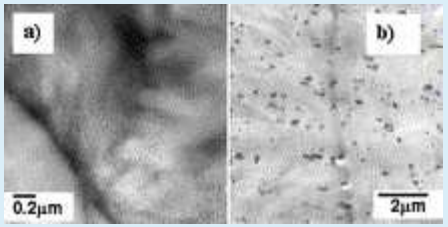
Fiber based, foams, nanocomposites, energy, coating

*Topic #2-*Thermoset Materials



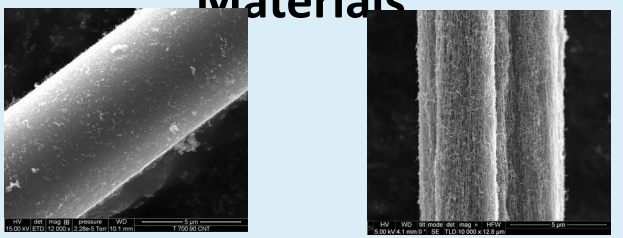
Influence of POSS structure on the fire retardant properties of epoxy hybrid networks.
E. Franchini et al. *Polymer Degradation and Stability*, 94, 1728-1736 (2009).

*Topic #3-*Nanocomposite Materials



In situ synthesis of organic–inorganic hybrids or nanocomposites from sol–gel chemistry in molten polymers.
V. Bounor-Legaré. *Progress in Polymer Science*, 39, 1473-1497 (2014)

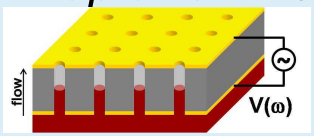
Topic #4- Composite Based Materials

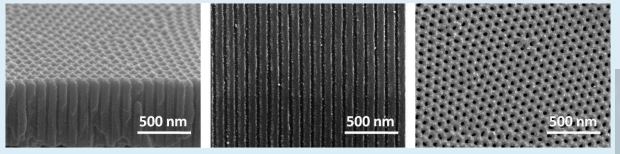


Synergetic catalytic effect of carbon nanotubes and polyethersulfone on polymerization of glassy epoxy-based systems–isothermal kinetic modelling. H. Beneš, et al. Thermochimica Acta, 590, 107-115. (2014)

3-Physics and Functional Properties of Polymer-based Materials

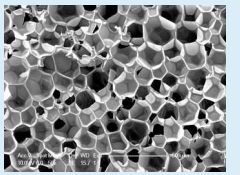
Topic #5- Materials for Energy





Density fluctuations and phase transitions of ferroelectric polymer nanowires.
A. Serghei et al. *Small*, 6, 1822-1826 (2010).

*Topic #6-*Foams



Batch foaming of chain extended PLA with supercritical CO_2: influence of the rheological properties and the process parameters on the cellular structure.
Y. Corre et al. *The Journal of Supercritical Fluids*, 58, 177-188 (2011).

Relationships between architectures-physical properties

Design of homogeneous or multiphased materials

(Multi) Functional Polymers with a multi-scale structuration

Reinforcement in bulk and at surface

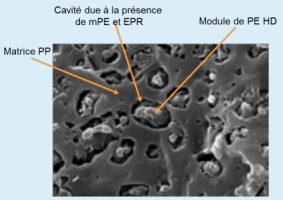
Segmentary Mobilities and electronic and ionic transport

Fiber based, foams, nanocomposites, energy, coating

*Topic #7-*Coatings

Homogeneously and gradually anchored self-assembled monolayer by tunable vapor phase-assisted silanization
G. Souharce et al. *RSC Advances*, 3, 10497-10507 (2013).

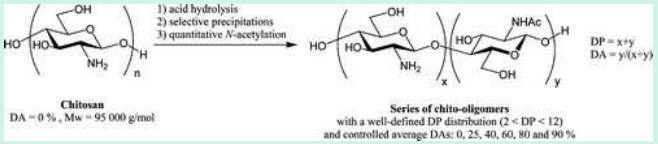
Topic #8- Recycling of Materials



Patents FR 2984894 et W 2013093364

4-Polymer and Life Sciences

Topic #1- Decoys materials : oligosaccharide and polyelectrolytes engineering



Chemical Preparation and Structural Characterization of a Homogeneous Series of Chitin/Chitosan Oligomers
S. Trombotto, Biomacromolecules, 9, 1731-1738 (2008)

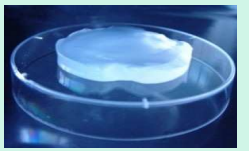
Oligosaccharides and lipo-conjugates with controlled structure

Complex colloids for targeted therapies and drug delivery

Multiscaled structured physical hydrogels based on glycosaminoglycans for tissue engineering

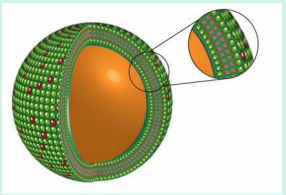
Multifunctional biocompatible polymers for nano-imaging cellular processes

*Topic #2-*Materials for tissue engineering



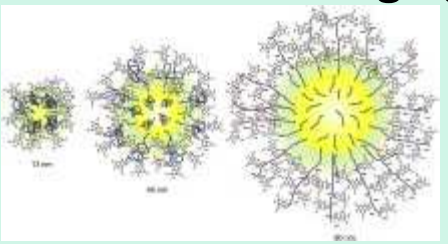
Montembault et al., Biomaterials, vol. 26, 2005, 933-43

*Topic #3-*Core-shell for vectorisation



An overview of lipid membrane supported by colloidal particles.
A.L. Troutier, Advances in Colloid and Interface Science, 133, 1 (2007)

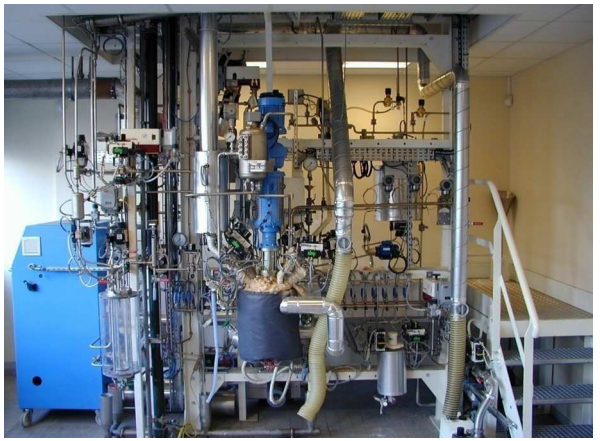
*Topic #4-*Polymer probes for fluorescence imaging



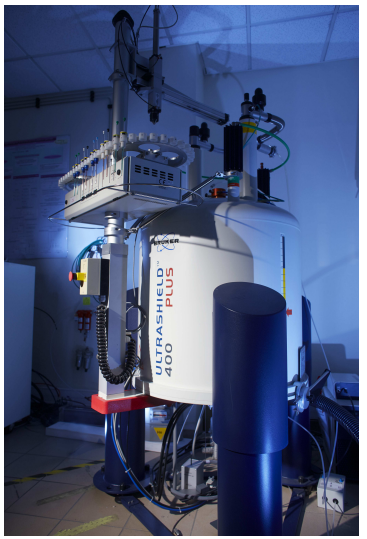
Nanocarriers with ultrahigh chromophore loading for fluorescence bio-imaging and photodynamic therapy.
J.R. Navarro, Biomaterials, 34, 8344-8351 (2013).

SPECIFIC TOOLS

Polycondensation Pilot Reactors

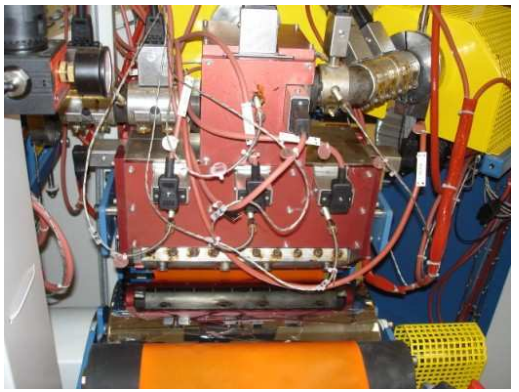


Chromatography and NMR Spectroscopy



Processing (at lab scale)

Coupling of Rheologie with Scaterring/optcal/diélectric/micro-waves



CROSSING OF KNOW HOWS AND SOCIETY ISSUES

		Know-hows			
		Chemistry	Rheology	Physics	Life Sciences
Society issues	Energy	Ionic Liquids	Nano filled	Dielectric	Electrical
	Transportation	Elastomers	Foaming	Composite	Mechanical
	Health	Silicon	Supercritical Fluids	Molecular Imprinted polymer	Bio Compatibility Tissue Engineering Vectorization
	Packaging	Biobased	Multi layer	Transport	Bio degradation
	Clean Tech	ROP	Recycling	Solvent free	Biodegradable

INDUSTRIAL PARTNERSHIPS

Close and friendly collaboration

One startup : 28 employees

2 M€ contracts