

Multi-lateral research initiative

Liaison Office Panel Session

Selected Topics (and/or connected subjects)

Topic 2: More generally ; Biomedical devices (bio-active artificial bones ; Hybrid composites with shape memory alloys or active polymers as artificial muscles; Bio-inspired artifacts ...

Topic 3: Passive and active piezo-sensors, optic fibers, electric and dielectric properties , ... for health monitoring devices ; Wireless sensors ; Pulsed eddy currents sensors for continuous monitoring

■ **connected subjects : Active patches with piezo-actuators or sma. , vibration reducing and /or self-healing ..**
Heterogeneous materials ' lifetime....

Multi-lateral research initiative

Liaison Office Panel Session

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Topic 4: Noise control :active and semi-passive approaches
(case of a smart board : coll. with IFS)

Topics 5 and 7 Controlling fluid dynamics at surfaces :
design of super lubricating surfaces , drag reducing piezo-
devices ; process improvement by interfacial air flow control.

**Topic 10 : Viscoelasticity in amorphous materials, polymers
and bulk metallic glasses**

Topic 16 : Smart surface films for control of friction and wear

Multi-lateral research initiative

Liaison Office Panel Session

Selected Topics (and/or connected subjects)

- **Topic 20: Materials and Structures under severe/extreme conditions : high temperature and /or pressure , irradiation .. stresss corrosion cracking, phase transformation,.... ;**
Fracture mechanics and related phenomena
Materials by design



Selected subjects
In Topic 2

Topic 2

Biomedical devices (bio active artificial bones):

From bone substitution to tissue Engineering

Ionic exchanges with body fluids (Ca, P; ..)

Collaboration:

**Jerome-Chevalier (GEMPPM
Insa de Lyon)**

**Makoto Ohta (Bio-Fluids Lab
(Tohoku University))**



Artificial bones with porous hydroxyapatite

Osteoblasts entering the porosity

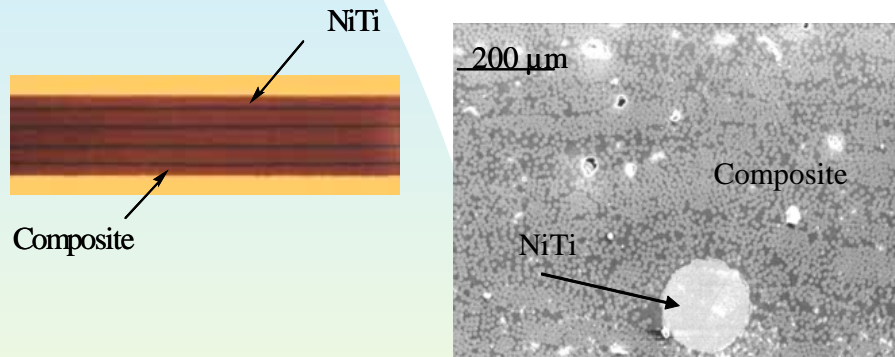
Topic 2

Shape memory alloys

Hybrid composites with shape memory alloys

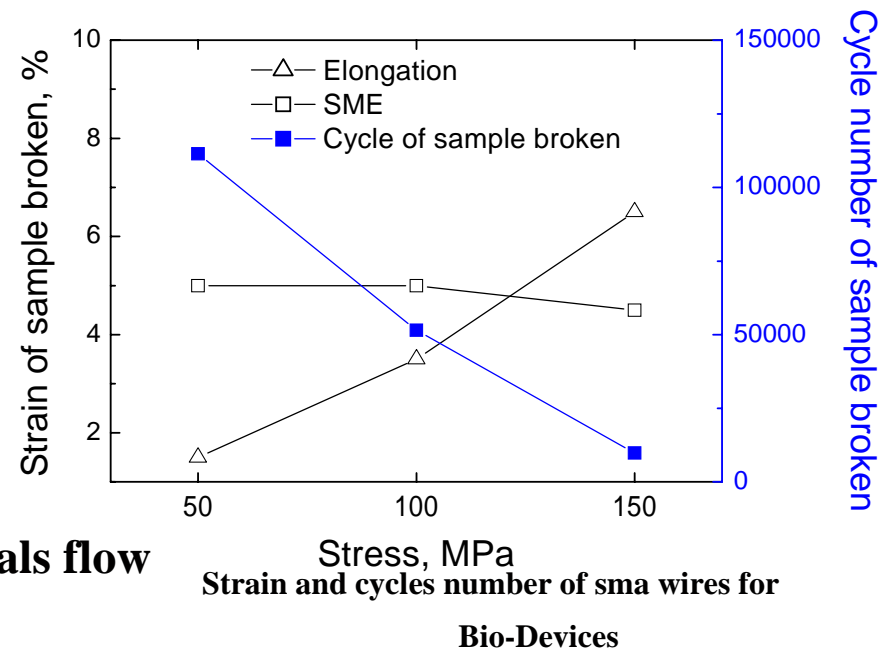
PROCESSING AND OPTIMISATION

Shape memory alloys used jointly as actuators and sensors



Hybrid composites (GFRP) with embedded shape memory wires as ‘artificial muscles.’

Durability and alloys-GFRP interfaces (materials flow at the interface)



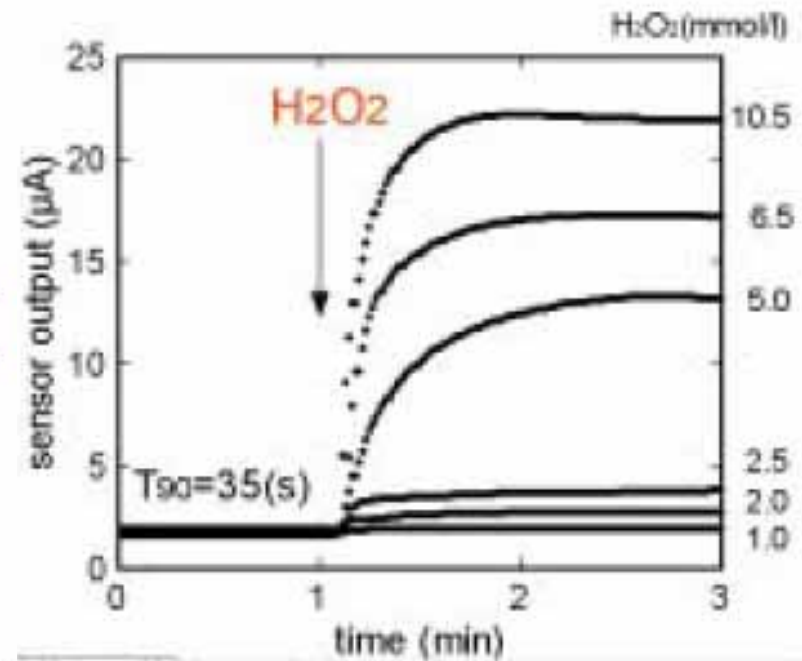
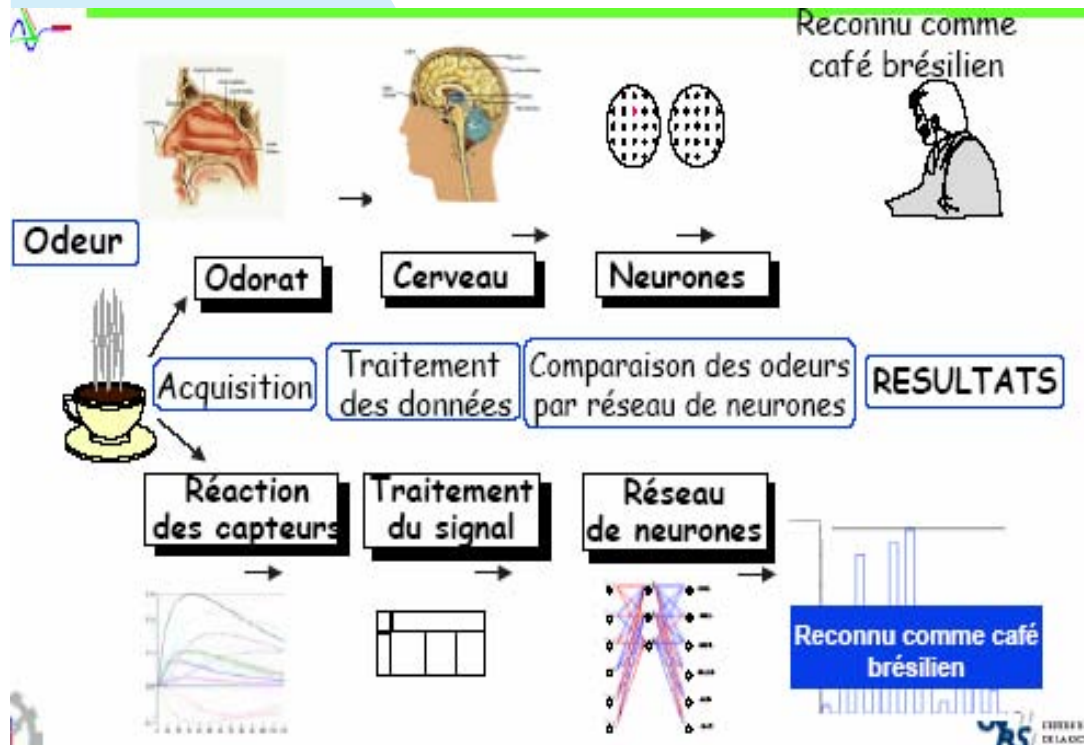
Michel.Morin GEMPPM INSA ; R. Ibuki and T. Takagi IFS TOHOKU

Michelle.Salvia LTDS,ECL, Yun Luo TUBERO TOHOKU

Topic 2

Bio-inspired sensors

Nicole.Jaffrezic_(E C Lyon);Kohji Mitsubayashi (Tokyo Medical Uni.)



Artificial nose

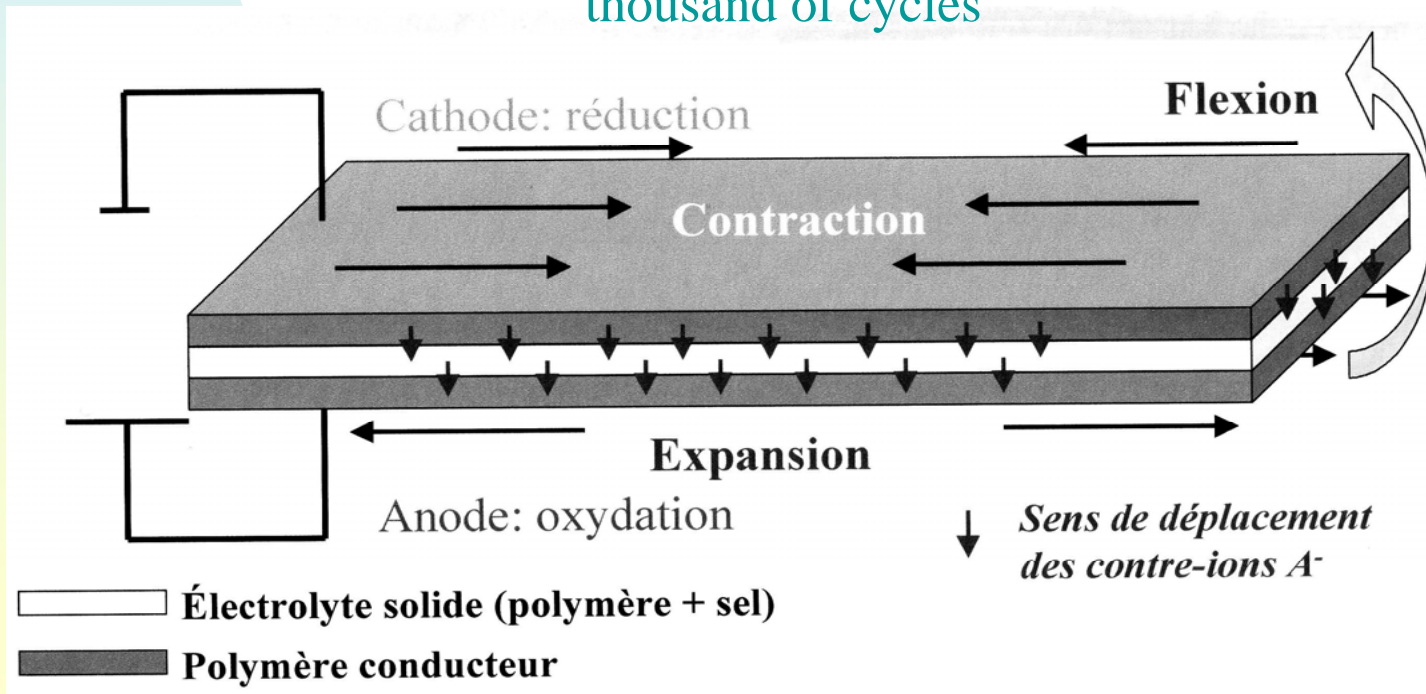
Bio-sniffers for odorless and colorless chemicals (H_2O_2 ...)

Use of metal doped D.L.C. ;Toshiyuki . Takagi

Active polymers

IPN polymer (PEO/PC) and 2 external sheets of ECP (PEDOT)

Good adhesion . After immersion in LiClO_4 high deflection angles for thousand of cycles





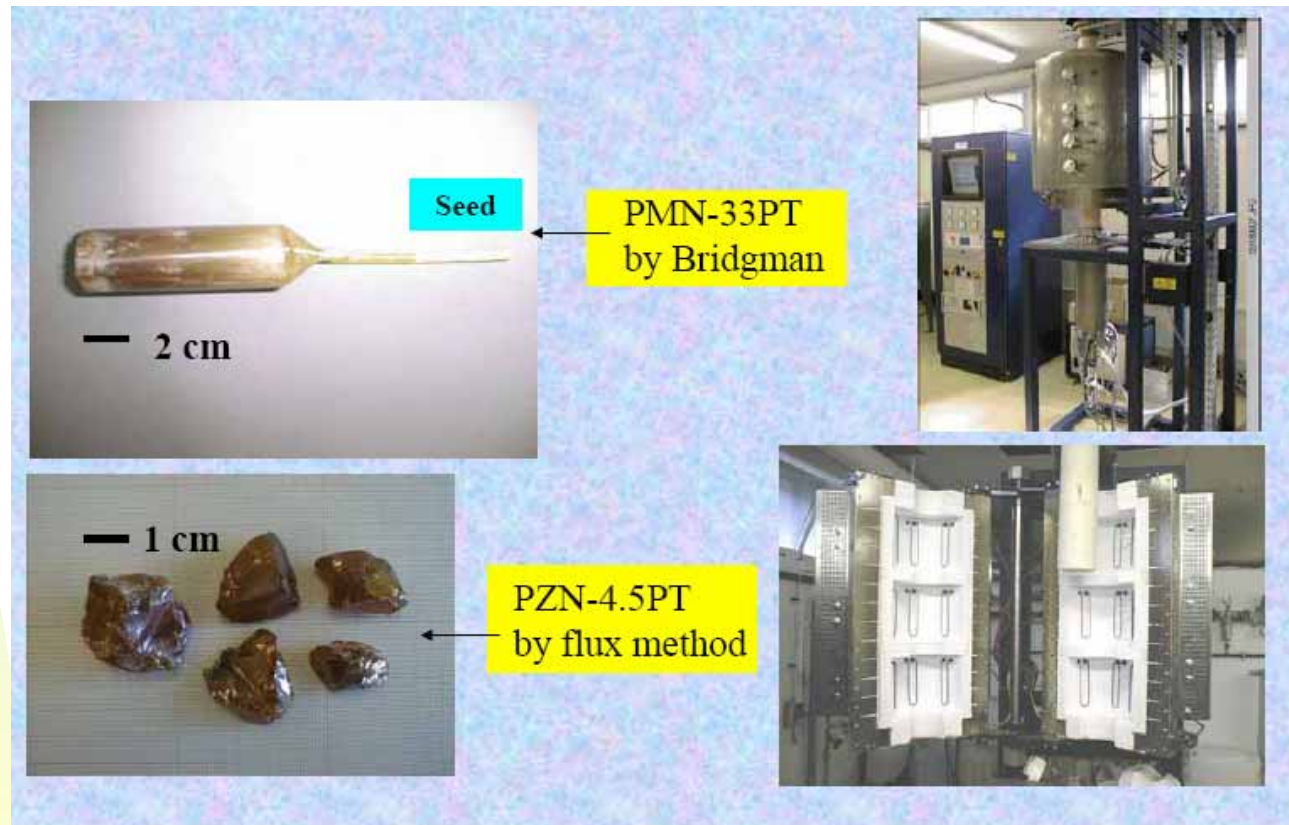
Selected subjects
In Topic 3

Topic 3

Lead based Relaxor Single crystals

Processing and usage

D. Guyomar, L.Lebrun
L.G.E.F. Insa de Lyon



High coupling coefficient ; Large increase of the bandwidth

Topic 3

Health monitoring of processing and usage of materials and structures* (1)

Active and passive Piezo-sensors .. Pulsed eddy currents sensors for continuous monitoring.

Joel Courbon, Philippe Guy, Yves Jayet INSA; TetsuyaUchimoto, Toshiyuki Takagi IFS

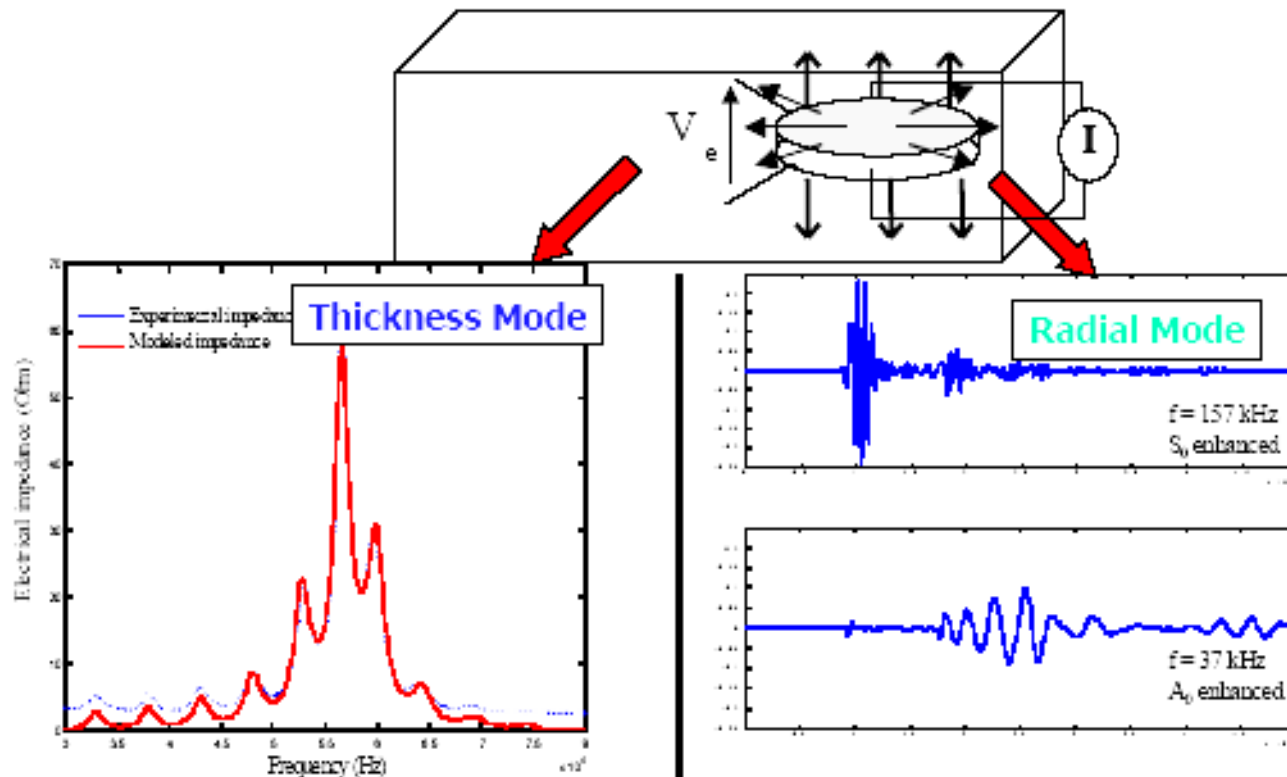
Life Prediction

Gerard Vigier INSA

Axis 1 of the Macodev cluster

Health monitoring of processing and usage of materials and structures* (2)

Piezoelectric inserted element double « active » function



- Viscoelastic properties monitoring through electrical impedance measurement
- Polymers curing process monitoring
- Hydrolytic ageing monitoring

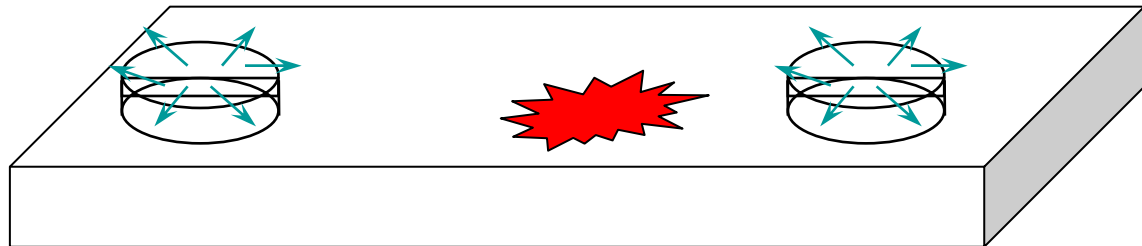
Detection, localization and characterization of localized damages by means of guided waves.

Topic 3

Wireless Sensors for continuous Health Monitoring (3)

D. Guyomar ,P. Guy, K. Yuse (INSA)

- The goal is to implement an energy harvesting system for powering a single AWT (Autonomous Wireless Transmitter) using our SSH (Synchronised Switch Harvesting) approach



- Such an autonomous transmitter has been evaluated on a 300x50x2 mm³ composite cantilever beam. Four 33x11X0.3 mm³ piezoelements are used for the energy harvesting and for the wave lamb generation.

Topic 3

Health monitoring of processing and usage of materials and structures* (4)

Basic knowledge in corrosion , Corrosion Engineering ,Durability and corrosion Stress corrosion Cracking *

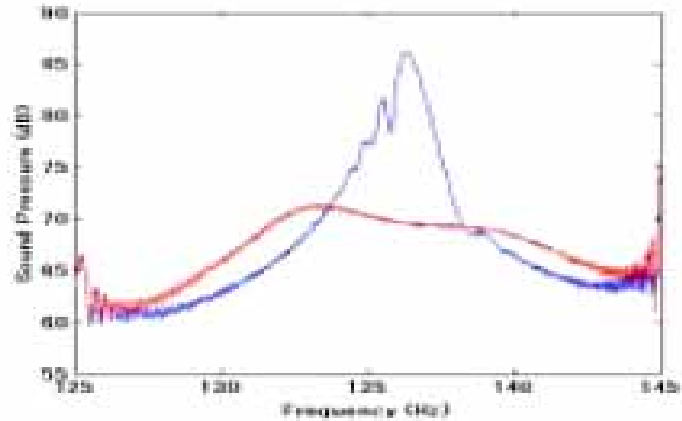
Bernard.Normand GEMPPM Insa

* Metallic structures ; Axis 1 of the Macodev Cluster

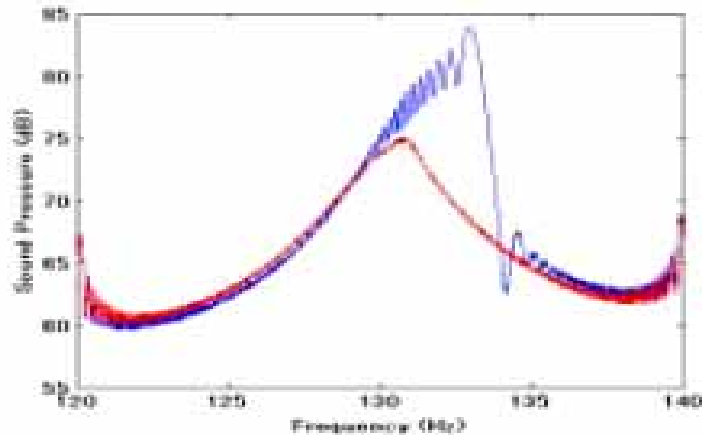


Selected subject
In Topic 4

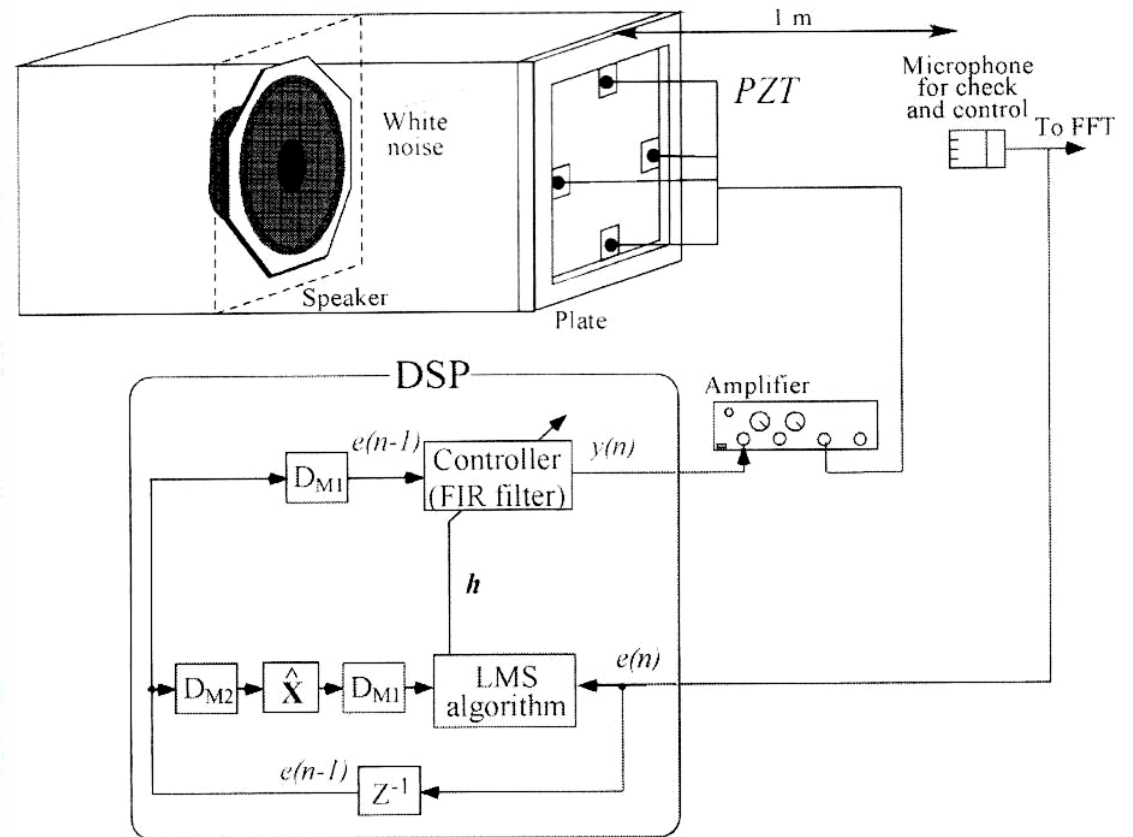
Topic 4 Noise control : active and semi-passive approaches



(a) Active control



(b) Semi-passive control



(Daniel.Guyomar LGEF Insa; .Jinhao Qiu IFS;Tohoku



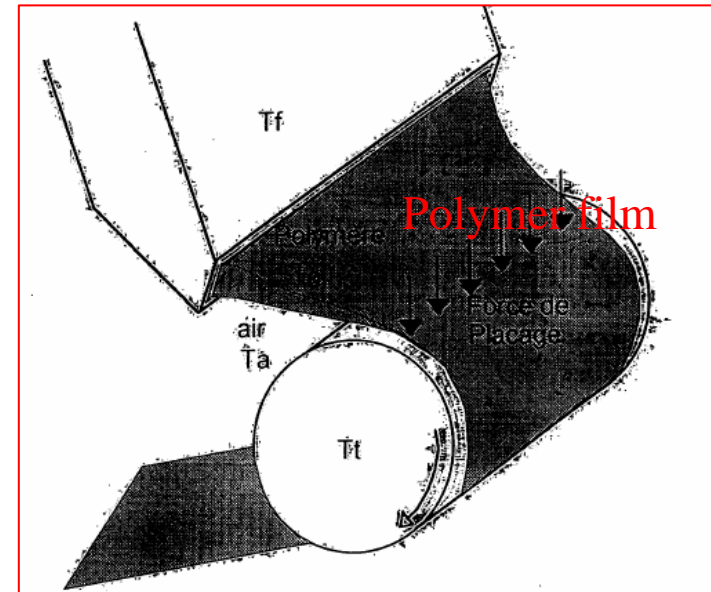
Selected subject
In Topic 7

Topic 7

Processing of thin polymers films

Theoretical study of multilayered viscoelastic liquid flows

- Process improvement by interfacial air flow control
- Decrease of interfacial instabilities by using compatible polymers



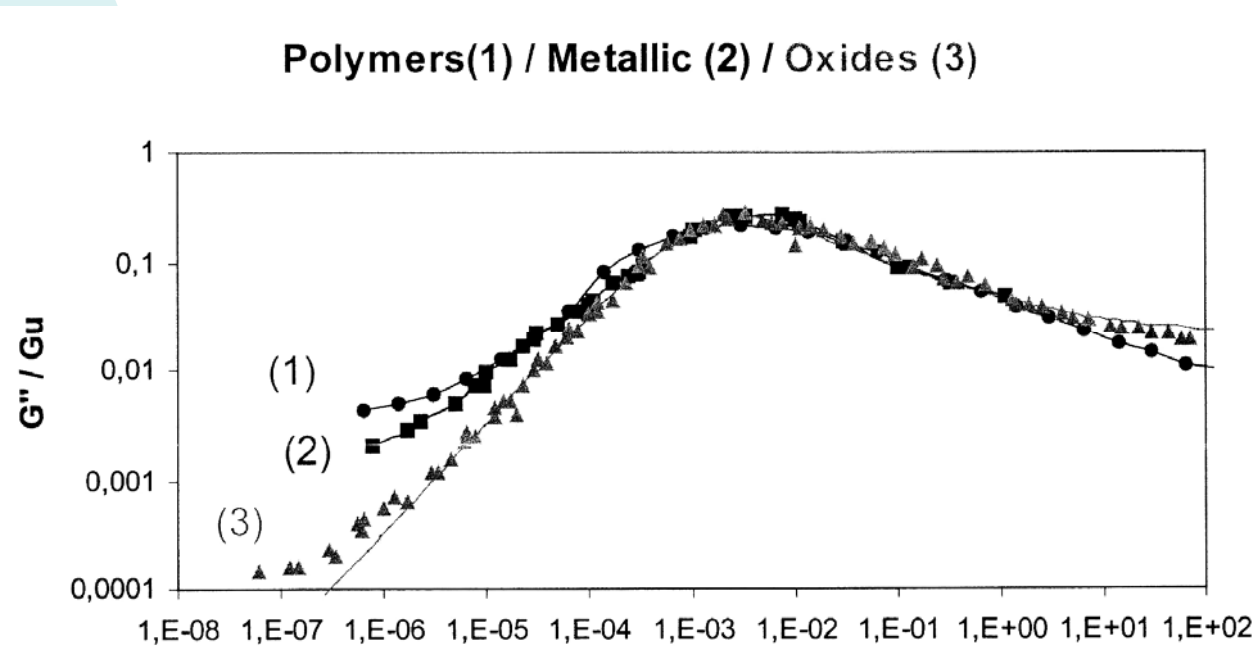
Patrick Bourgin Insa de Lyon Plasturgy group
and E.C.L.



Selected subject
In Topic 10

Viscoelasticity in amorphous materials

- Bulk metallic glasses (Zr,Ti,Cu,Ni,Be),...
- Polymers (PET),



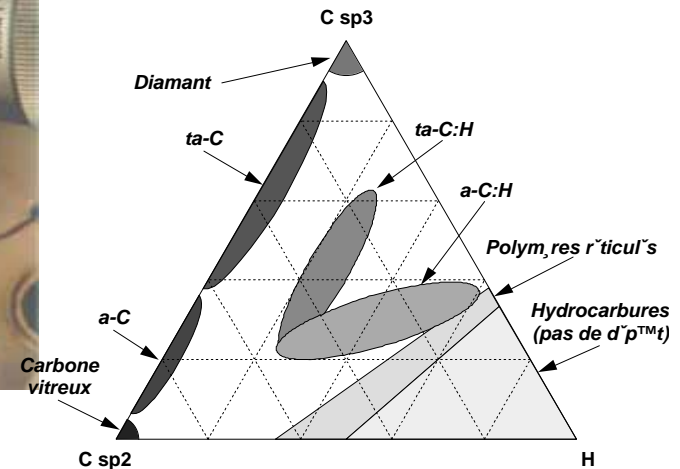
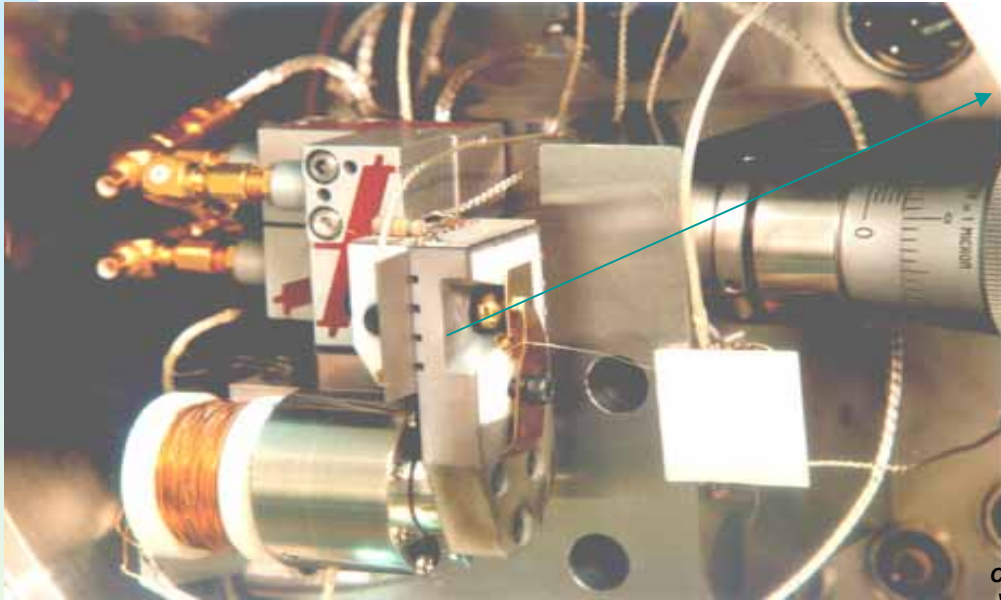
- **J.M. Pelletier GEMPPM Insa**



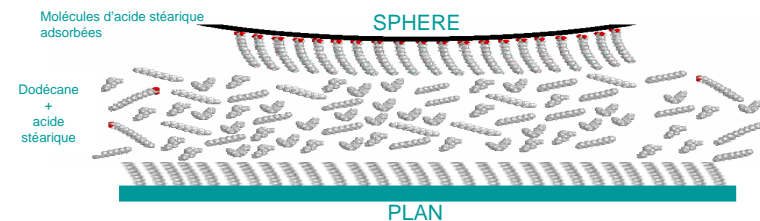
Selected subject
In Topic 16

Topic 16

Smart Surface Films for Friction Control



Metal-doped deposition



Molecular Tribometer (10 nN ; 0.001nM)

Frictional and Wear Nanomechanisms

Denis Mazuyer , J. Fontaine (LTDS ECL)

Toshiyuki Takagi , T. Takeno (IFS, TOHOKU)

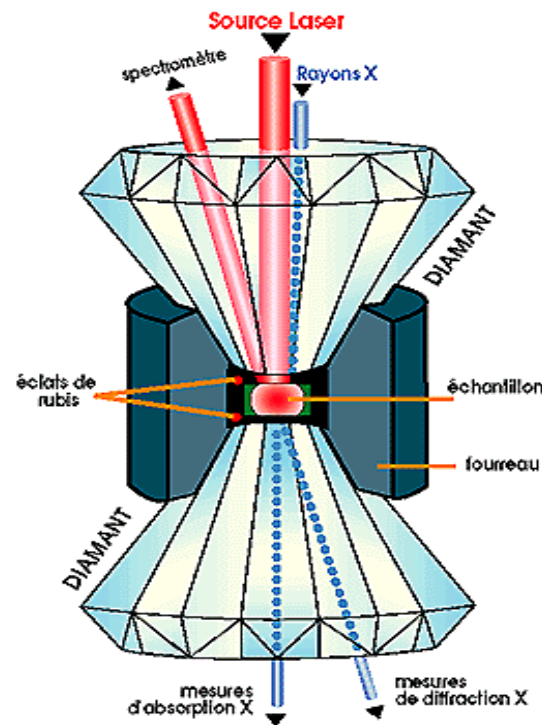


Selected subjects
In Topic 20

Topic 20

Materials and Structures under severe/extreme conditions : high temperature and /or pressure ,*

Bruno.Reynard
Ens-lyon.



Axis 6 of the Macodev cluster

Electron beam Irradiation

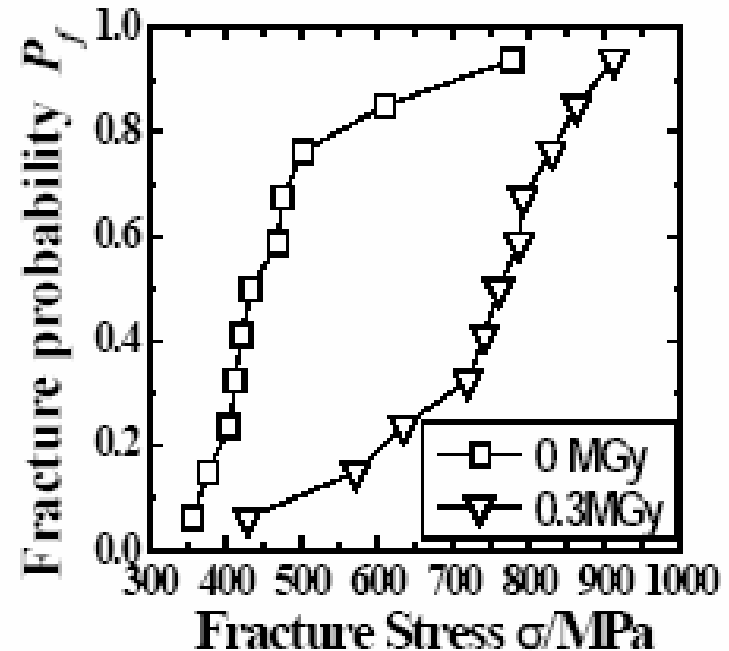
And mechanical properties of CFRP and GFRP

Michelle Salvia (Ecole Centrale de Lyon)

Yoshitake Nishi (Tokai University)

Enhancement of tensile, bending and impact mechanical properties

This enhancement is probably in relation with one ductility enhancement of the epoxy resin and carbon fibers



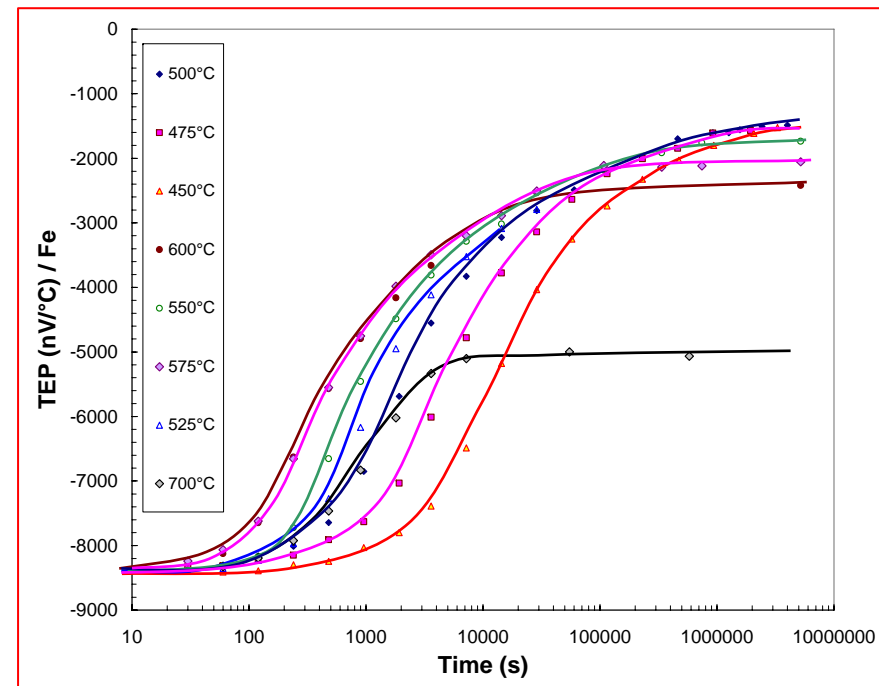
Topic 20

PHASE TRANSFORMATION

Relations Processing \leftrightarrow microstructure and mechanical properties
Diffusional Phase Transformation : precipitation in steels

Coupling between modeling
(classical nucleation theory
and atomic scale approaches
;coupling bet. Monte-Carlo
(kinetics) and Mol. Dynamic),
and experiment (T.E.P, TEM)

Jacques.Merlin
Michel.Perez
GEMPPM Insa



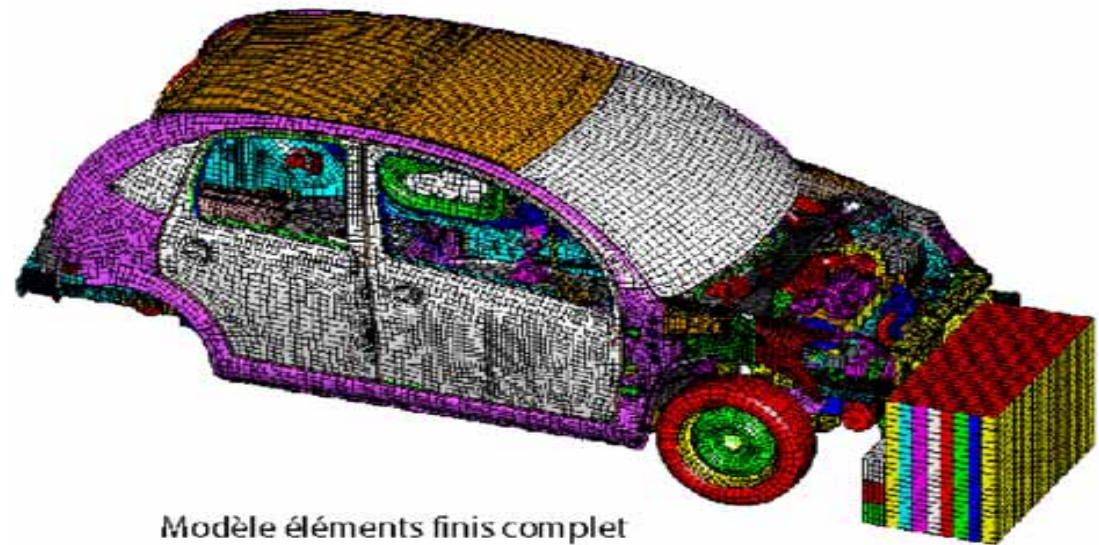
Precipitation of Copper in Iron

Topic 20

Fracture mechanics and related phenomena ,*

Alain.combescure@insa-lyon.fr

Finite elements modelling



LAMCOS

*Axis 6 of the Macodev Cluster

Topic 20

MATERIALS BY DESIGN*

- Prof. Y. Bréchet (INPG, Grenoble)



- criteria for materials and processes choice,
- design of materials and systems for specific (multifunctional) applications: materials with internal architecture, interface with structural and mechanical engineering, etc.
- **Example : materials with specific mechanical / thermal / acoustic properties**

* Axis n° 7 of the Macodev cluster



Selected subjects

In Topic 21

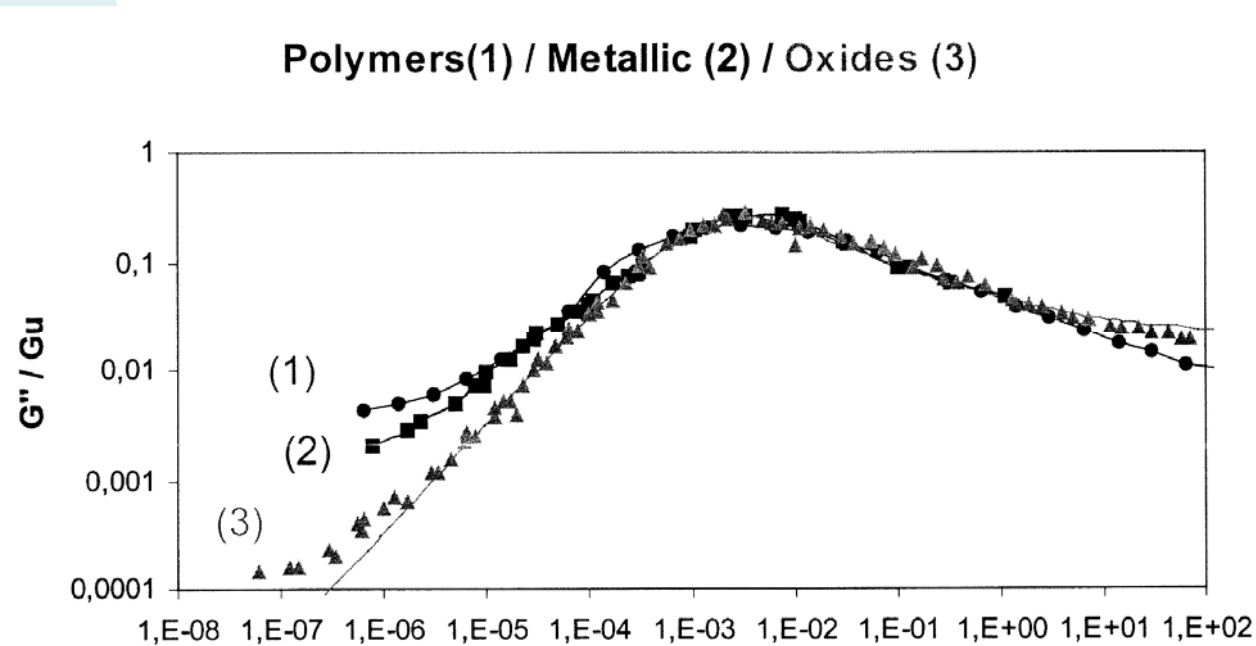
Materials flow

Proposition for a 'materials flow' Topic (21)

- **Viscoelasticity of amorphous systems (Tohoku, Insa, Sidney... ?)**
- **Processing of thin polymers films (Insa, ECL .. ?)**
- **Durability of the mechanical properties of S.M.A –GFRP interfaces in artificial prosthesis (Tohoku (IFS and TUBERO) , ECL .?)(adaptable wings for UAVs ?)**
- **Behaviour of metal-doped DLC coatings in friction control and processing of sensors (Tohoku, ECL, ...?)**

Viscoelasticity in amorphous materials

- Bulk metallic glasses (Zr,Ti,Cu,Ni,Be),...
- Polymers (PET),



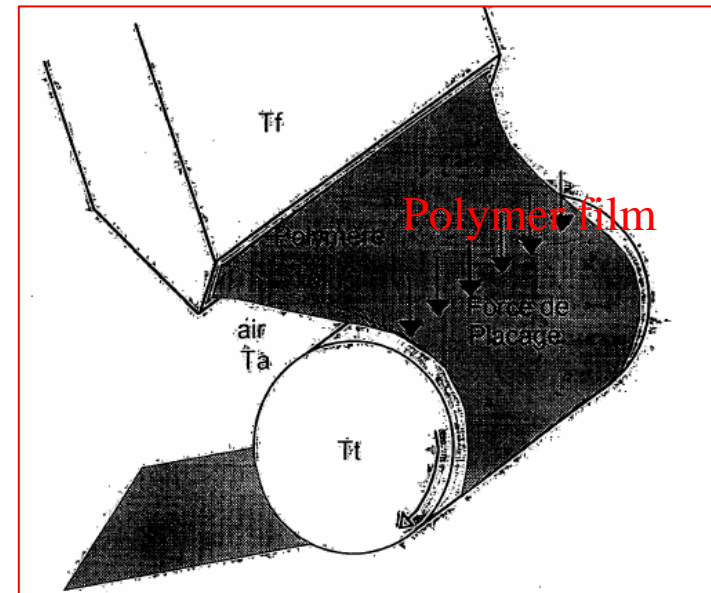
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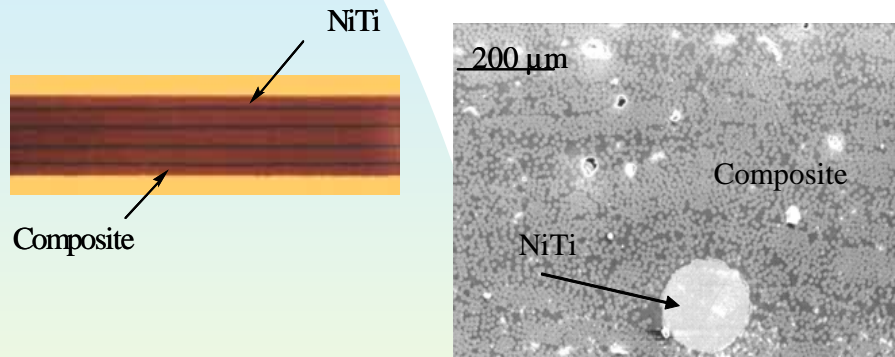
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Shape memory alloys

Hybrid composites with shape memory alloys

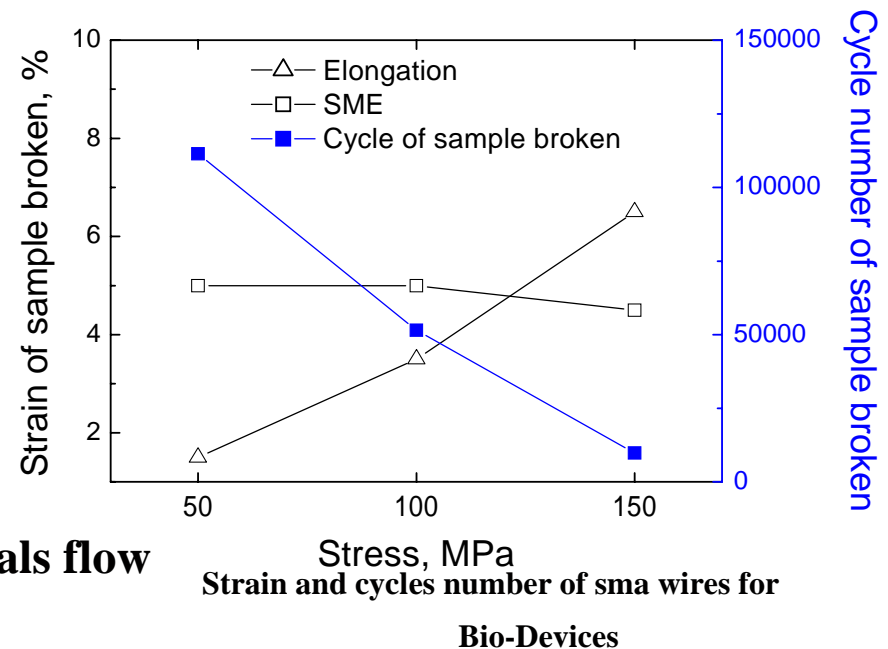
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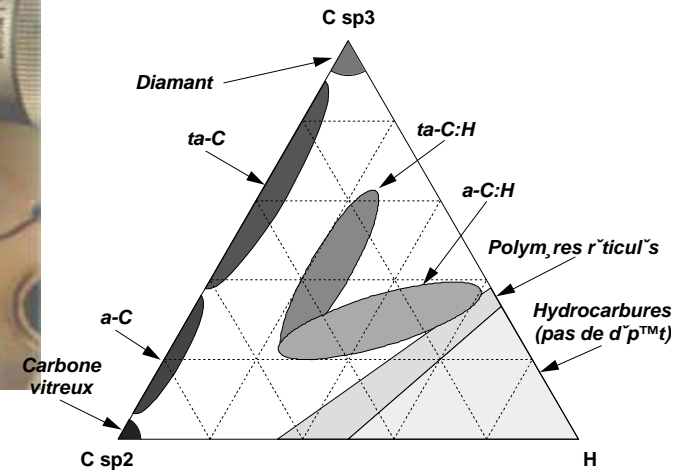
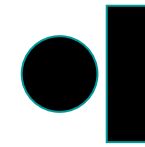
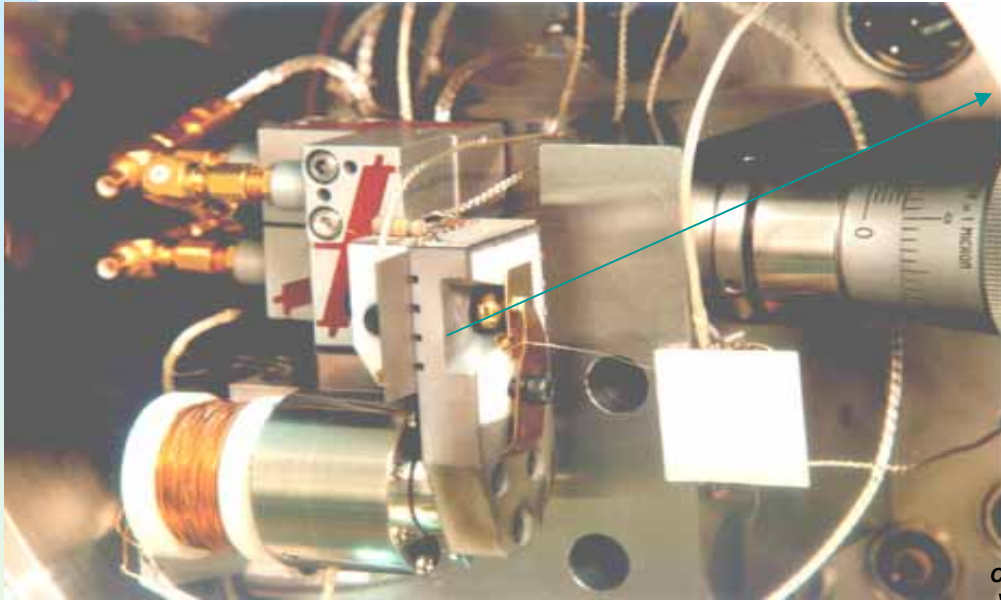


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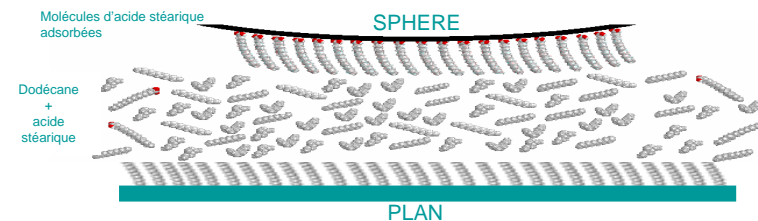
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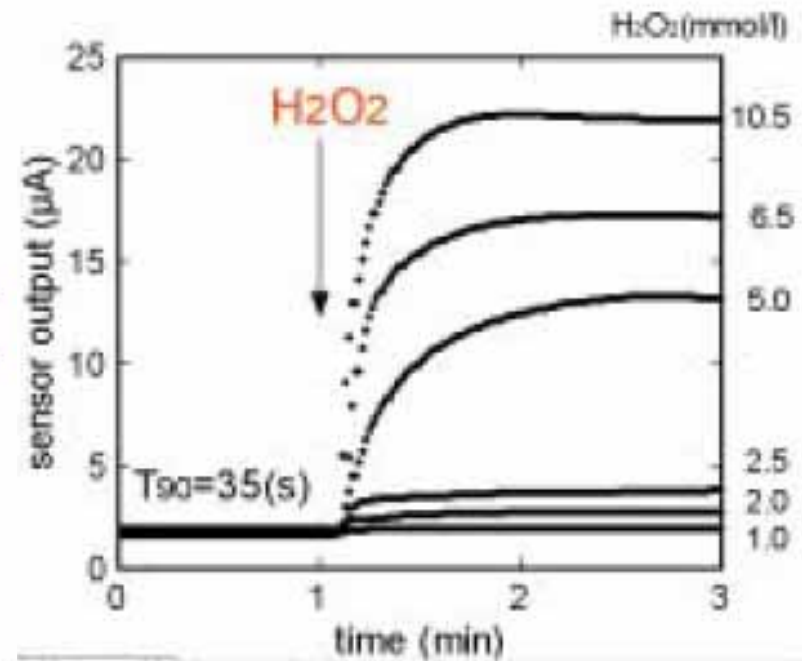
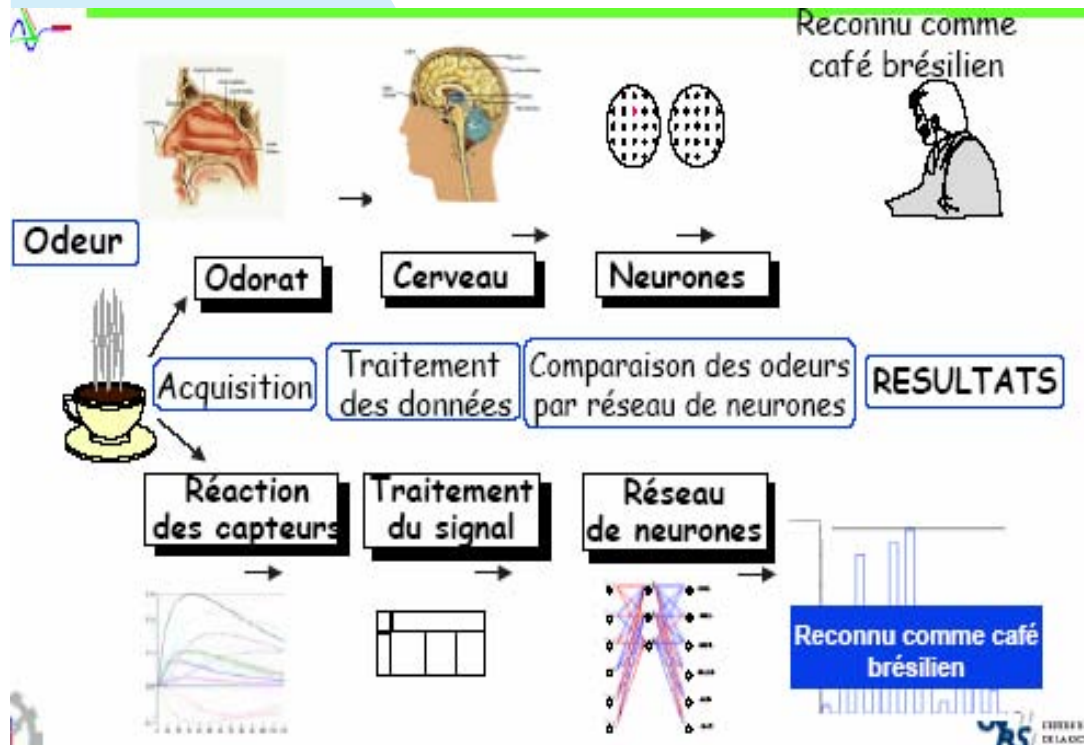
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Artificial nose

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