

IMEP-LaHC

(UMR 5130: UGA, Univ. Mont Blanc, CNRS, Grenoble INP)
Gustavo ARDILA, Grenoble Alpes University

- ~200 researchers/technical staff/students, 3 research groupes (Micro Nano Electronic Devices)
- Number of people involved in the GDR: 4
- Area of expertise of the labs: Simulation, caracterisation (electrical, electromechanical), Integration of nanostructures into devices
- CNRS and/or univ section: Section 8 (CNRS)
- Which preferential axes ? 3 and 6

AXE
Élaboration
Mesures de propriétés
Mesures de performances de dispositif
Simulations/Théorie



N A M e

GDR Nanomaterials for Energy Applications

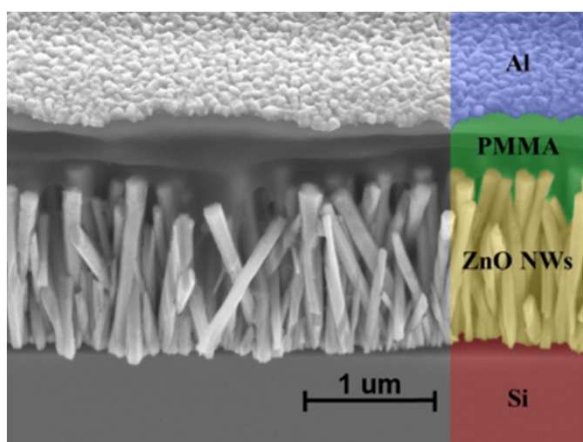
ELABORATION
MEASUREMENTS & METROLOGY
SIMULATIONS & THEORY
APPLICATIONS



Scientific expertise, overview, major themes in relation to the GDR

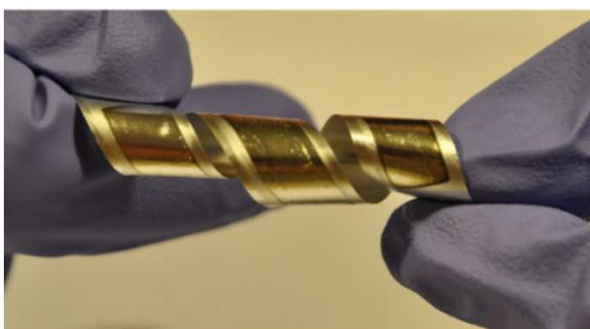
- main research subject :
Piezoelectric semiconducting nanowires and thin films (ZnO, GaN, etc.) and related devices
- Type of energy conversion
- What kind of applications are targeted ?

Piezoelectric nanowires based nanocomposites



Output:
~ mV-V,
0,14mW/m²

S. Lee et al.,
Adv. Funct.
Mater. 2014



Type de conversion d'énergie

Piézoélectrique

Application relative à l'énergie ou autre

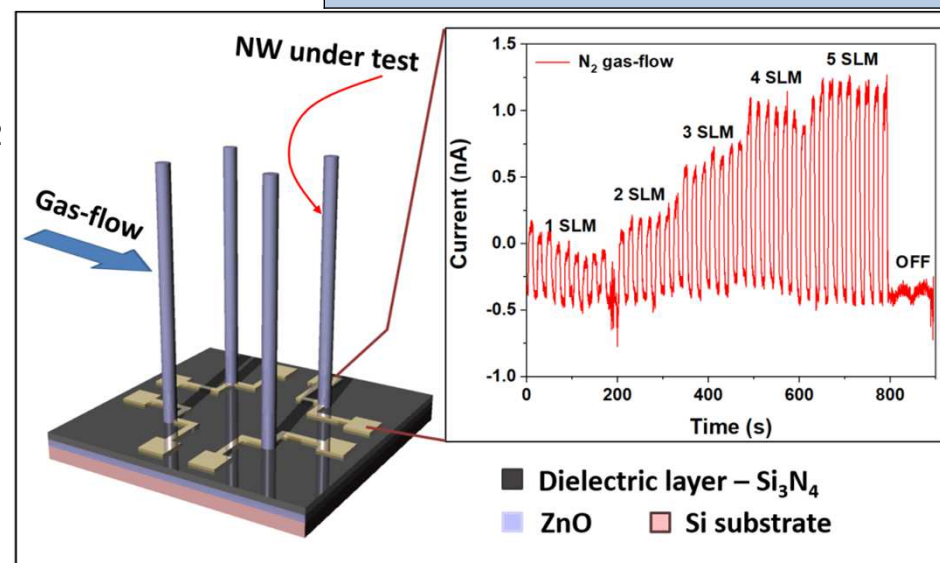
Récupération (0,14mW/m²)

Stockage

Capteurs

Gestion thermique des nanodispositifs

Dispositifs flexibles

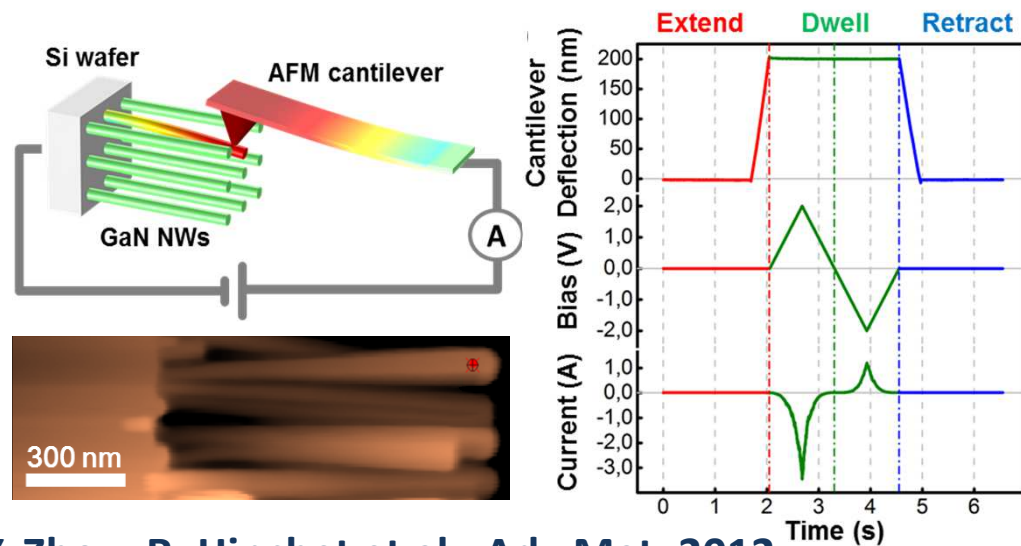


with CEA-LETI

M. Parmar et al. Nano Energy 2019

Technical or technological expertise in relation to the GDR issues (1/3)

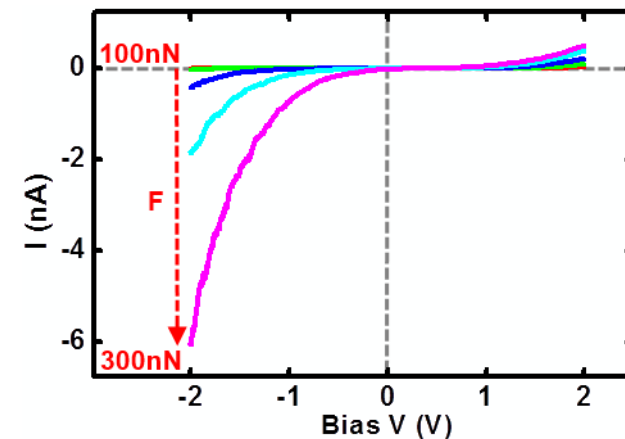
- What kind of materials/dimensions
Piezo NWs (50-200nm wide, a few μm long) and thin films from partners (ZnO, GaN, etc.)
- What kind of characterization technique are mastered by the lab/group/team
Near field : AFM – PFM, I-V, KPFM, Scanning Microwave Impedance Microscopy, home-made techniques
- Special instruments or methods



Y. Zhou, R. Hinchet et al., Adv Mat, 2012

GDR Plenary meeting may 2021 <https://gdrname.fr>

Caractéristiques physicochimiques
Electrique
Mécanique
Electro-mécanique
Type et taille caractéristiques des nanomatériaux
Caractérisation d'objets
Simulations

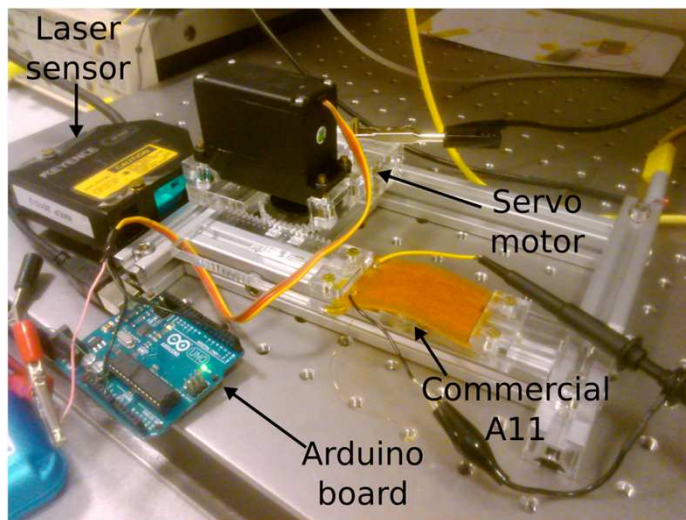


Technical or technological expertise in relation to the GDR issues (1/3)

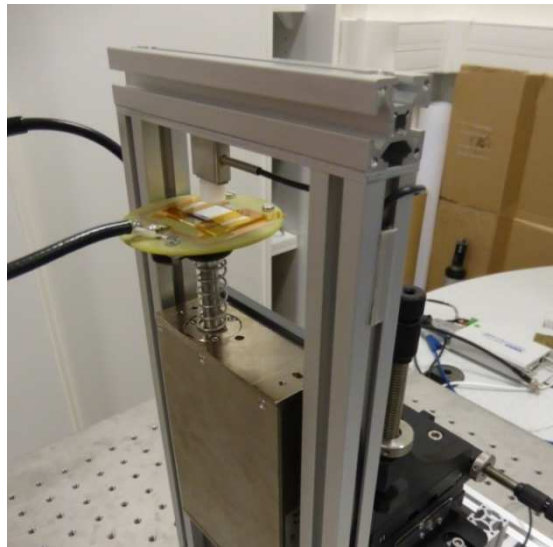
- What kind of materials/dimensions
Piezo NWs (50-200nm wide, a few μm long) and thin films from partners (ZnO, GaN, etc.)
- What kind of characterization technique are mastered by the lab/group/team
Device level : Home made characterization set-ups
- Special instruments or methods

Caractéristiques physicochimiques
Electrique
Mécanique
Electro-mécanique
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Simulations

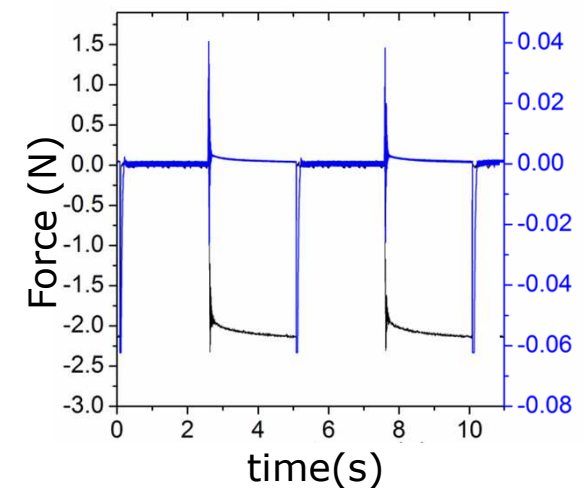
Bending set-up ($F < 40\text{N}$)



Compression set-up (15N)



Example :



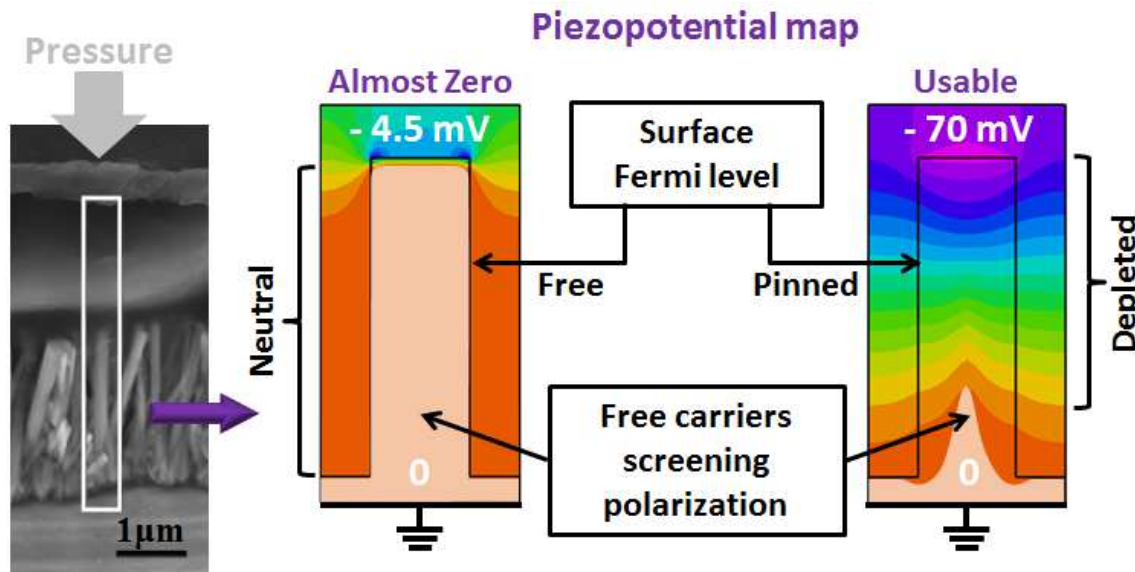
M. Parmar et al. Semicond. Sci. Technol. 2017.

GDR Plenary meeting may 2021 <https://gdrname.fr>

Technical or technological expertise in relation to the GDR issues (3/3)

- Codes/numerical tools/modelling
Finite Element Method (COMSOL, FlexPDE)
Fully coupled-equations : piezoelectric,
electrostatic, semiconductor

Optimisation guidelines



Caractéristiques physicochimiques

Electrique

Mécanique

Electro-mécanique

Type et taille caractéristiques des nanomatériaux

Caractérisation d'objets

Simulations

Looking for collaborations ??
(materials, devices...)

R. Hinchet et al., Adv. Funct. Mater. 2014

R. Tao et al., Nano Energy 2015

R. Tao et al., Adv. Electron. Mat. 2018

A. J. Lopez Garcia et al., Nanomaterials 2021