Instituto Nacional
de Tecnología
Industrial

INTI

MEMS activities in Argentina: the INTI experience

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MEMS activities in Argentina: the INTI experience

- INTI Introduction
- Electronics and Informatics Centre
- MEMS : the INTI experience
- MEMS Design and Technology Project
- The MEMS' Team

Instituto Nacional de Tecnología Industrial

INTI is a descentralized organization from the Argentine Government established in 1957,

INTI´s mission is promoting development and technology transfer to industry...

...and help industry meet improved international competitiveness.

INTI strategic lines

Innovation and integral solution
for industry problems...

Socially valuable services..

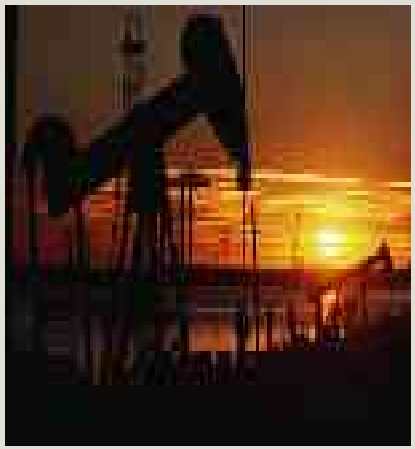
Technological capabilities through international cooperation...

INTI major areas

Food
Materials and industrial processes
Energy and enviroment
Quality
Metrology
Chemistry and petrochemistry
Electronics and Informatics
Construction and infrastructure

INTI services to industry:

Technical Assistance
Research and development
Training
Product quality and certification
Environmental protection
Tests
Analyses and calibrations



INTI-industry link

Representatives of SME and firms associations are partners of INTI, in the Centres´ Executive Committees and act as decision-taking authorities.

The " corporate governace" provide an active follow-up of the activities as well as the necessary guidance.

INTI´s Research and Development Centres

Twenty sectoral Research and Development Centres are located in the Province of Buenos Aires mainly in the so called Miguelete Technological Park.

Eight Regional Research and Development Centres are located in different provinces

INTI-Electrónica e Informática

Research and Development Centre for Electronics, Telecommunications and Informatics

INTI-Electrónica e Informática

The Centre has as its main object to assist firms of related industrial sub sectors in their technological modernization and international competitiveness

EMC in Microelectronics

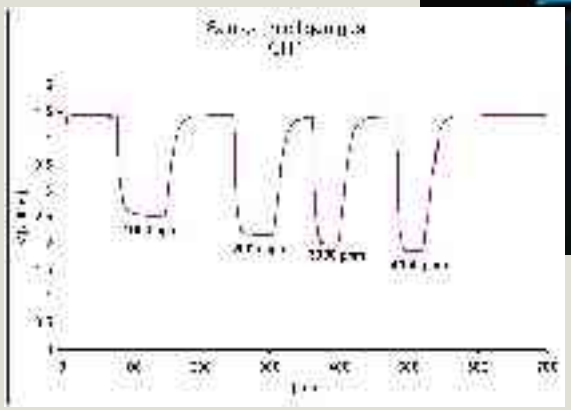
- INTI work together with local manufactures to improve his products
- Given technical assistance and product testing

Gas Sensor Development

- Screen-printing technology applied to gas sensitive films
- Development of SnO2 inks

Natural Gas Detector

- In cooperation with the firma IBRA SRL
- INTI has develop a natural gas and monoxide detector for home and industrial use



INTI-Electrónica e Informática

- We se our self as: (Almost arbitrary...)
- An applied research Centre with high level industrial testing facilities, and
- Technologically oriented to the microelectronics applications and MEMS developments

MEMS : the INTI experience

- Metrology applications
- Nanostructured materials for MEMS
- Microrelay

MEMS in Metrology

AC/DC MEMS

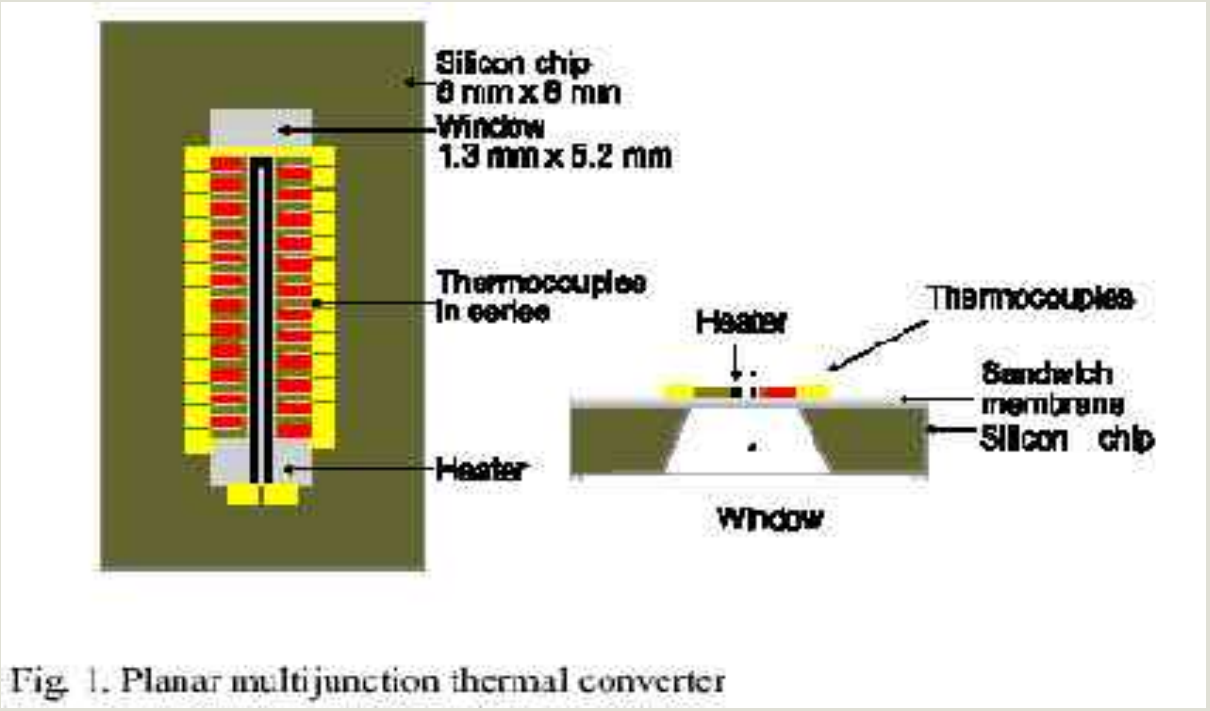


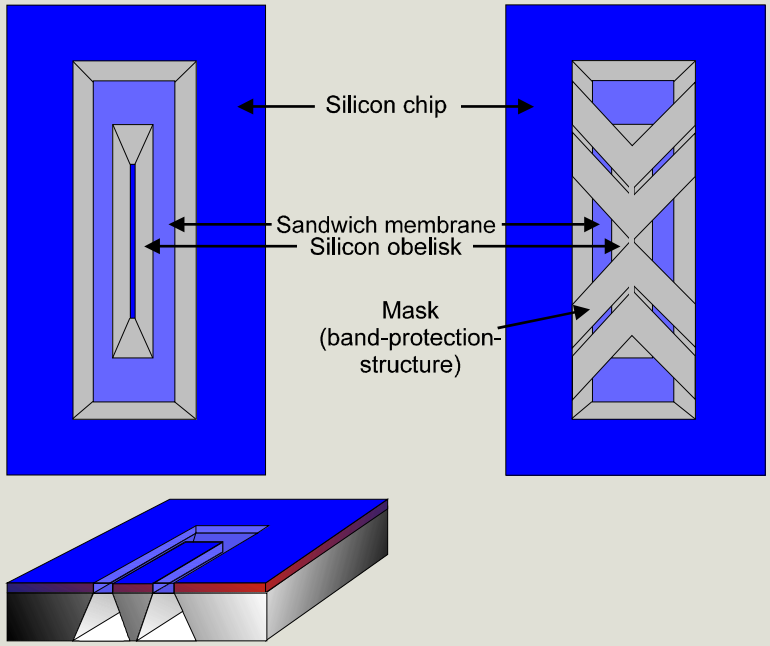
Fig. 1. Planar multijunction thermal converter

Thin-film Multijuntion thermal converterwere first developed at the PTB by Klonz and Weimann in 1986

MEMS in Metrology

AC/DC MEMS

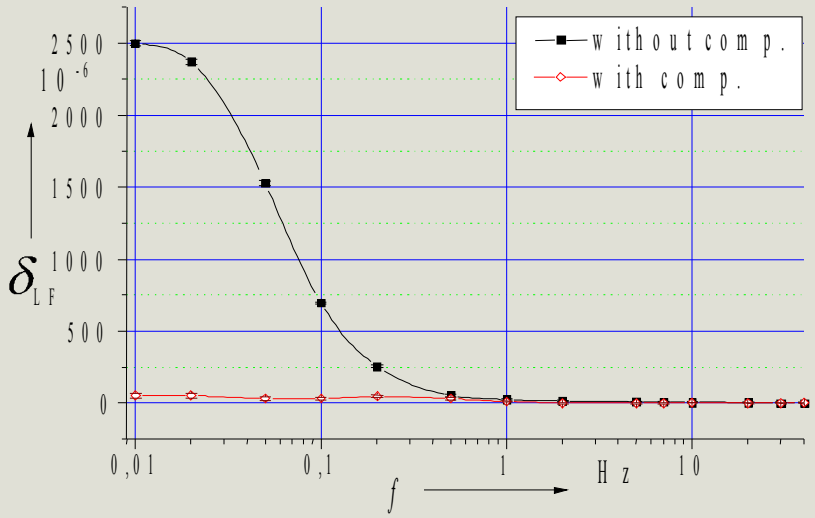
To increase the thermal time-constant down to 10 Hz a thermal mass has been placed under the heater



MEMS in Metrology

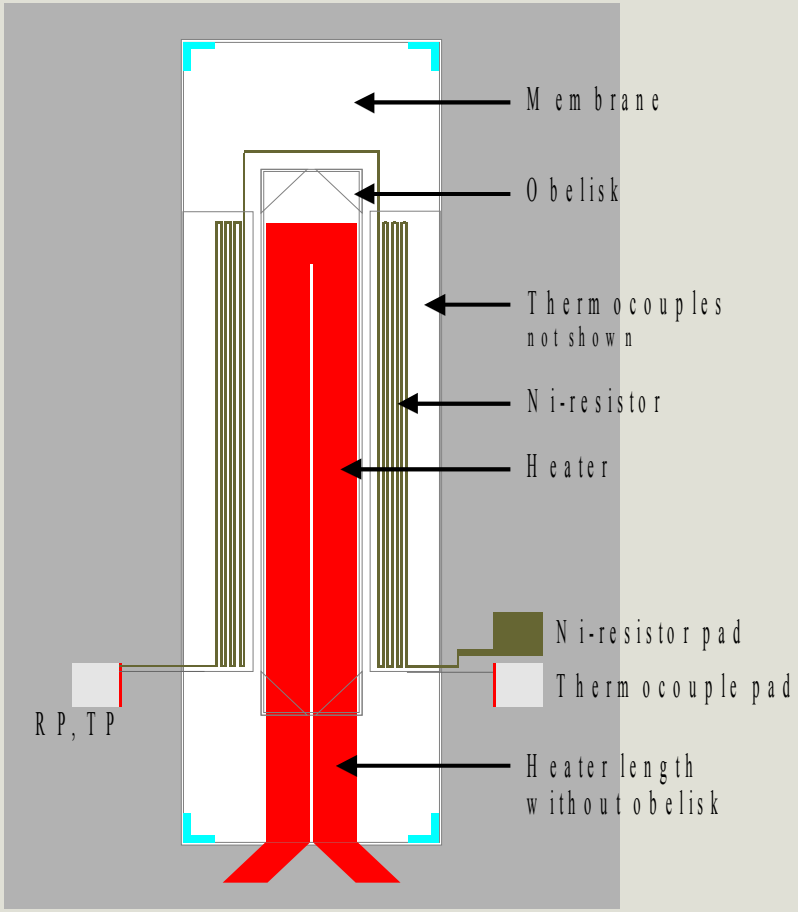
- Design Improvement

The developed electro-thermal model of the device is used to optimise the design for the reduction of the ac-dc transfer difference at low frequencies.



Standard uncertainty: below 0.3·μV/V at 10 Hz .

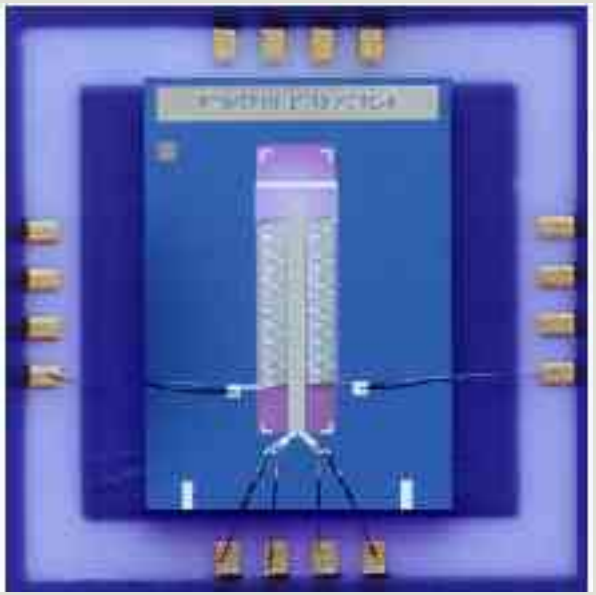
MEMS in Metrology



- Design Improvement

To decrease the nonlinearities AC/DC converters a thin-film Ni-resistor deposited underneath the thermocouples and connected to load the output voltage were designed and manufactured

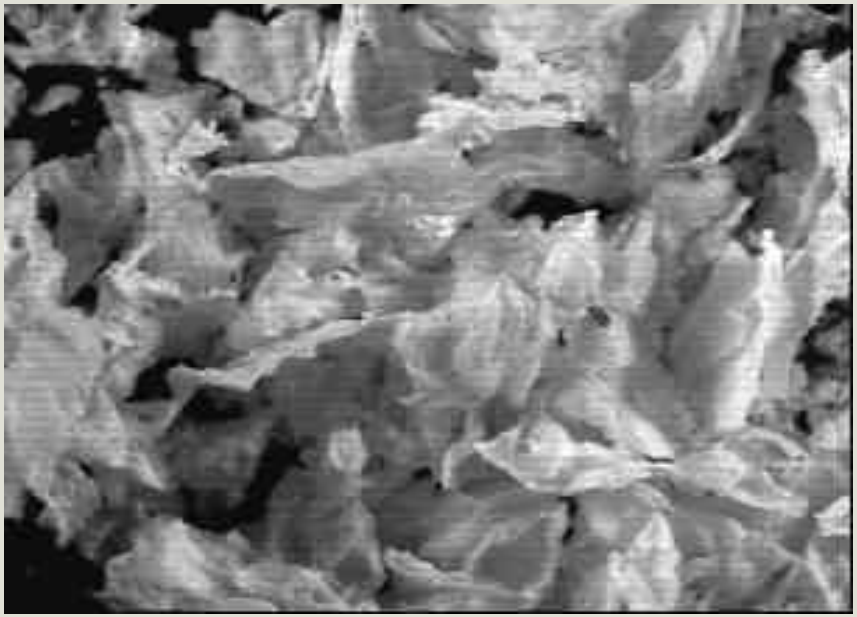
MEMS in Metrology



The converter chip glued on a Ceramic chip-carrier

- Al thin wires are bonding betwen chip and carrier Ag-pads
- The Different versions of MEMS ac-dc transfer were manufactured in IPHT of Jena Germany

Nanostructured materials for MEMS

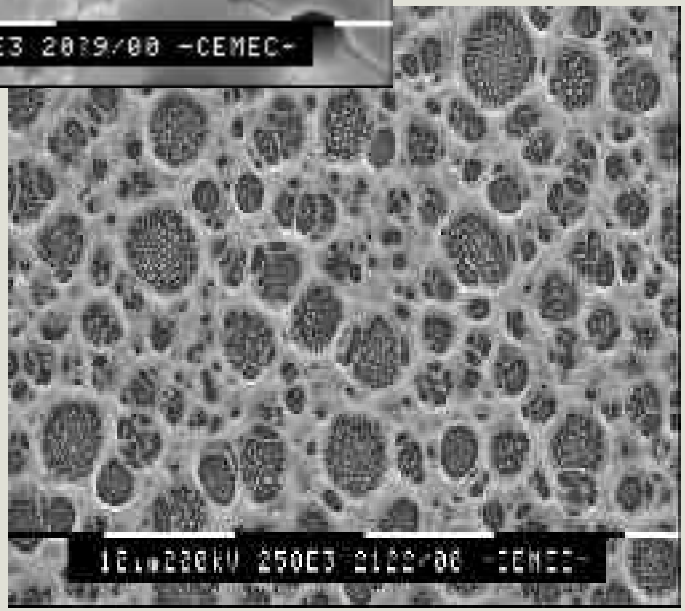


- Tin oxide nanopowder for improved response of gas sensors

- Nanocrystalline SnO_2 powder developed by novel syntesis method
- 10 nm were obtained
- process based on Gel-combustion of citric acid

Nanostructured materials for MEMS

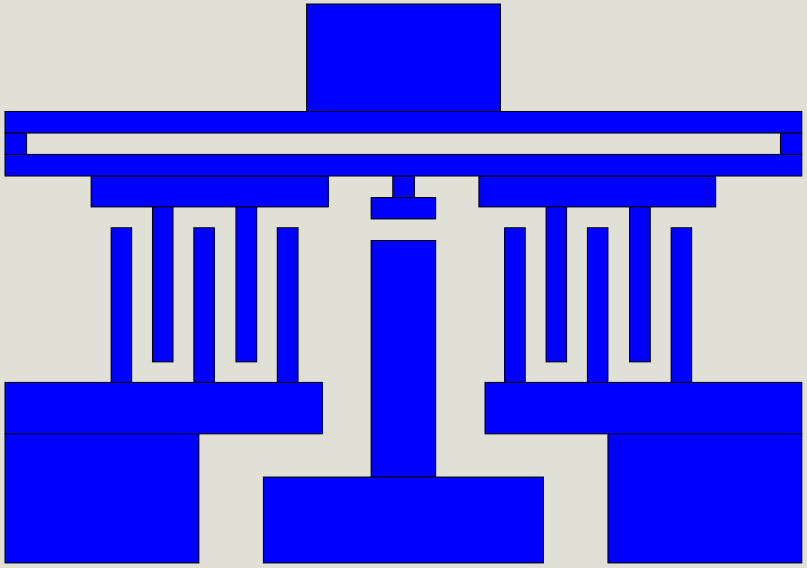
- We work in the use of standard gold pastes improves Nitrogen-dioxide sensitivity
- Thin film gold capacitors in MOS technology
- Using metal-organics gold inks for open gate structures on thick film technology



Microrelay

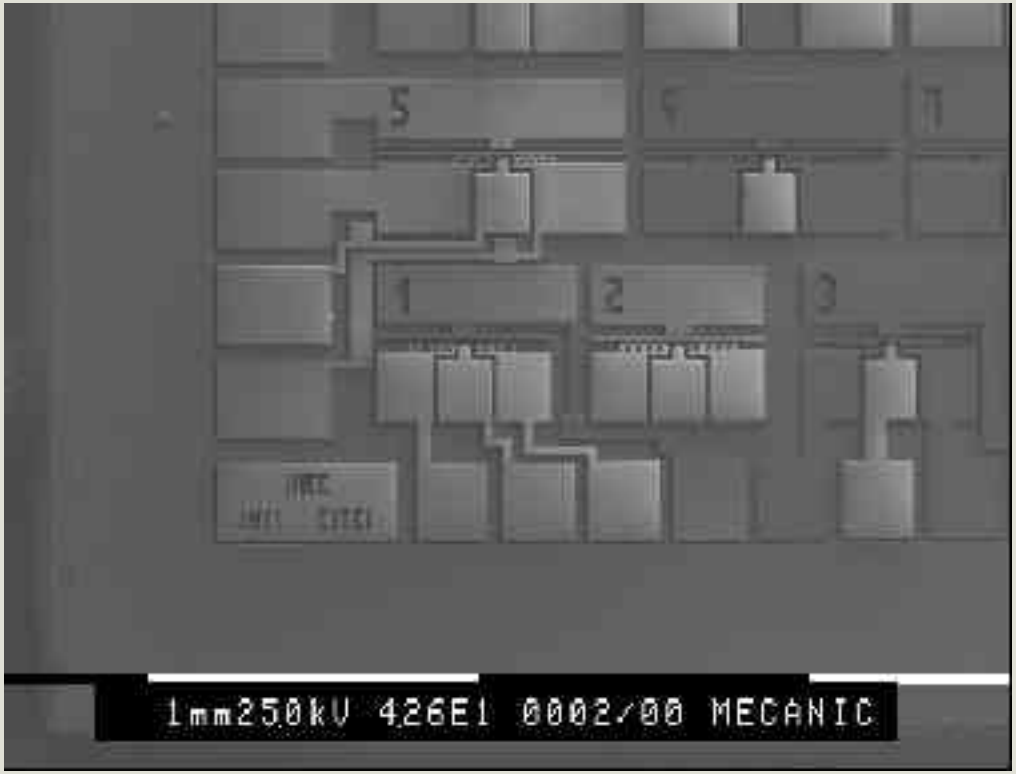
- Design parameters:
- Double-fold spring
- Size defined by its width: 700 µm
- SOI process allow complete design in one mask
- Cadence layout editor

Comb drives - Electrostatic actuator



Microrelay

- Prototypes Fabrication:
- TRONIC'S Microsystems
- Multi project Wafer ru service
- Epi-SOI Process
- 20 micro crystal thick
- 0.4 micro sacrificial layers



Microrelay

Microrelay Packaging:

Technology:

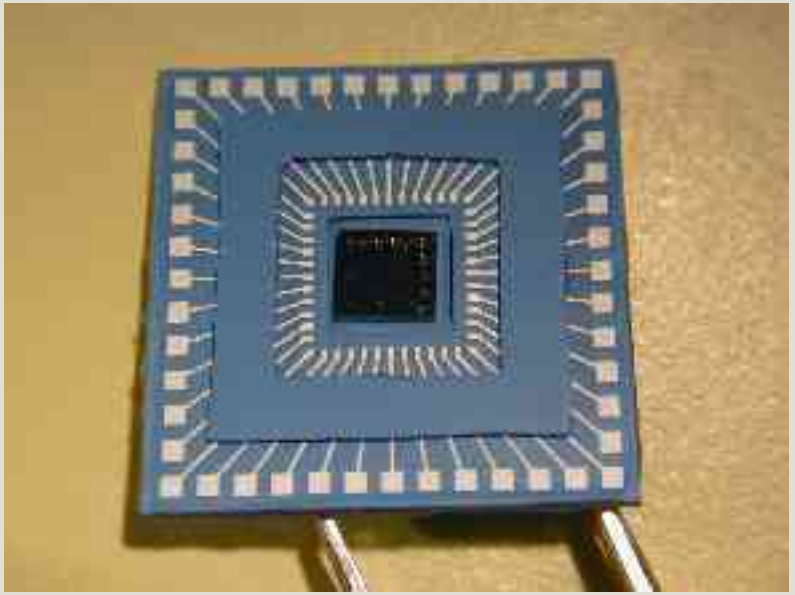
Low Temperature Co-fired Ceramic (LTCC)

Multilayer

minimum pitch = 750 µm

line width = 200 µm

12 layers



Microrelay

Microrelay Testing:

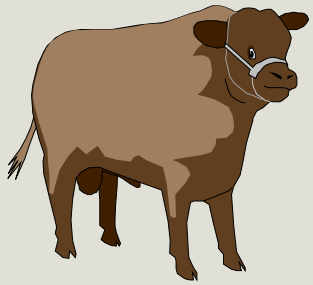
Carried out in a Wentworth Probe Station.

Threshold voltage was measured for several devices.

After nickel deposition

Performed in USP, Brasil

Livestock traceability



Argentine and regional requirements:

Europe demand the traceability of all meads imported since January 2003.

Potential market:

The region of the Mercosur: with 10 million heads of cattle in Uruguay, 60 millions in Argentina and more than 100 millions in Brazil.

Project Focus:

Agro-food traceability

- Microelectronics Traceability Systems for recover the confidence of the consumers and endorse the credibility in the consumption of bovine meat.

- RFID and MEMS technologies:

- RFID for the implementation of the transponder, for reading without contact

- MEMS for the incorporation of sensors, for the historical evolution of every animal or food unit.

MEMS Design and Technology Project I

Working program:

- In October 2000 IMEC and INTI subscribed an agreement The program was based on the transference of IMEC's knowledges to INTI-CITEI and the mutual activities of cooperation
- Two Argentine Scientists were coached by IMEC in Design and packaging of MEMS.

MEMS Design and Technology Projec II

Working program:

•In 2003 the National Agency for Science and Technology sponsor an initiative to upgrade current thick film technology INTI´s facilities, moving to design and packaging thin film sensors and microelectromechanical systems.

•In 2004 the European Union support the INTI's Electronics Traceability Project in the frame of competitiveness of Argentinean SME Program.

MEMS Design and Technology Projec III

INTI

Equipment in use:

Wet Station and Spinner
Semiautomatic Screen Printer
Wedge Wire Bonder

Equipment we are buying:

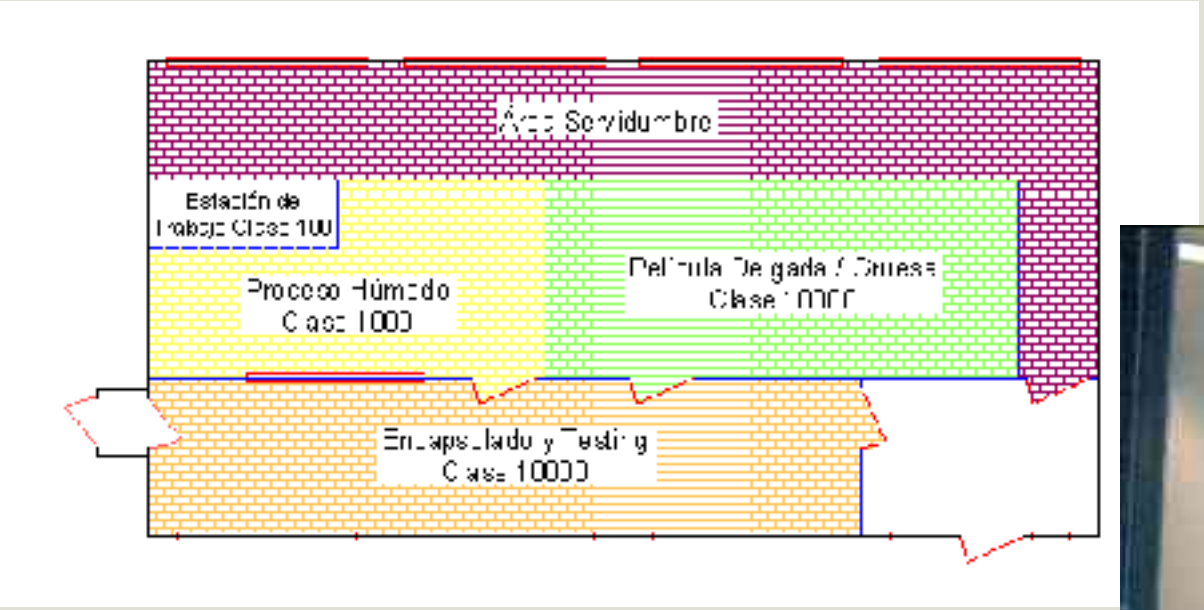
Mask Aligner
Scriber / Dicing
Ellipsometer
Sputtering / Evaporation
Ball Wire Bonder
Wafer Probing System Semiconductor Parameter Analyzer
Die Pick and Place System

Thick Film Facilities:

Upgrading current thick film technology INTI´s facilities

Moving to Green tape and ceramic packaging development

Clean Room Building



Setting up new facility at INTI

Clean room (70 m²)

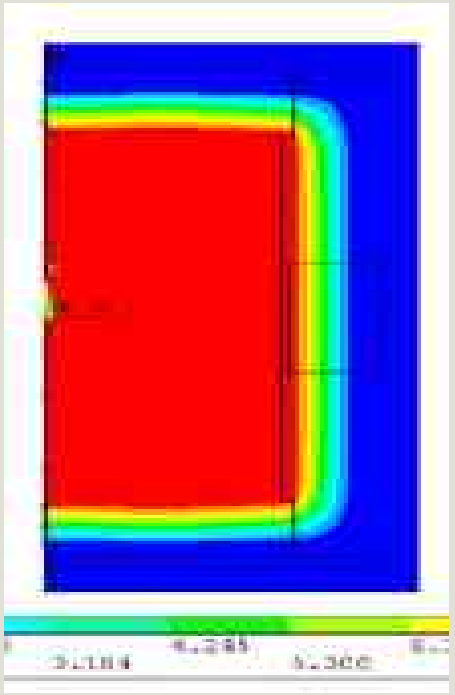
Post processing

The MEMS' Team:

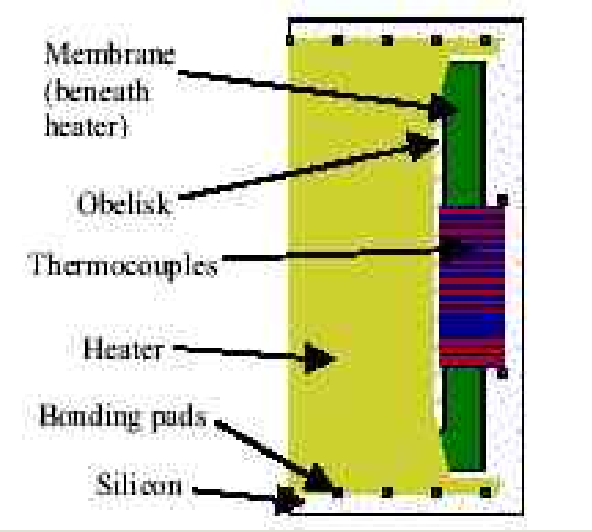
- Hector Laiz

  Metrology applications of MEMS, design and thermal modelling

  (Metrology Program)



Temperature distribution



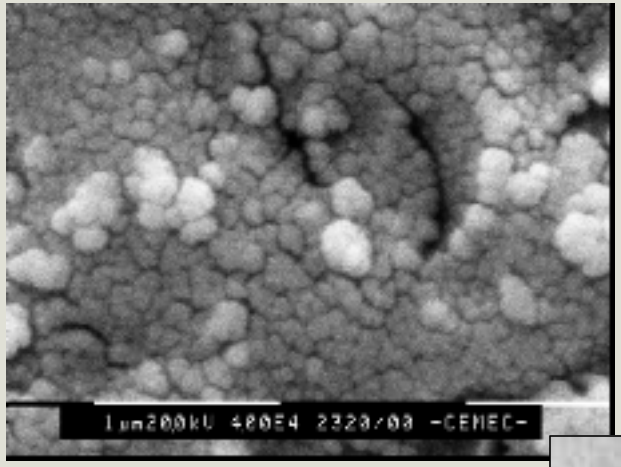
Layout of one-half of 1A ac/dc MEMS (NIST)

The MEMS' Team:

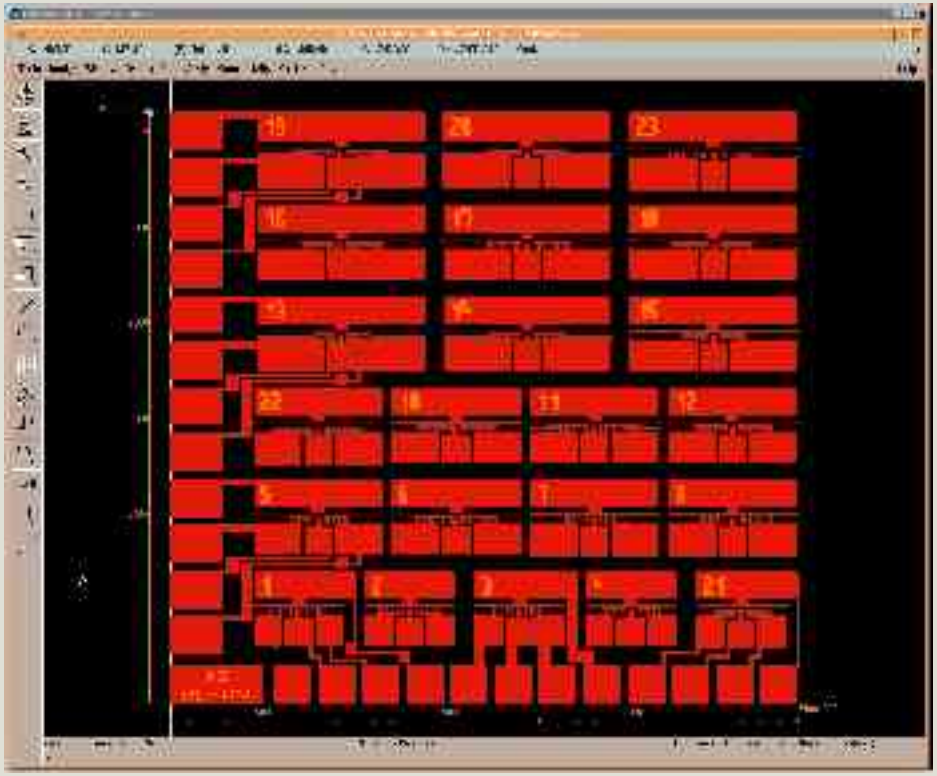
- Liliana Fraigi

  Thick film Gas sensor based on Sn O2 Nanoparticles

  (Electronics and Informatics Centre)



The MEMS' Team:



- Alex Lozano

  MEMS design
  applied to microsensors and microactuators.
  Modeling and simulation of MEMS.
  Electrical testing and characterization of MEMS devices.

  (Electronics and Informatics Centre)

The MEMS' Team:

ML and UL antenna with RFID 2nd level packaging

- Laura Malatto

  Packaging on LTCC

  Thick film Mechanical sensors

  (Electronics and Informatics Centre)

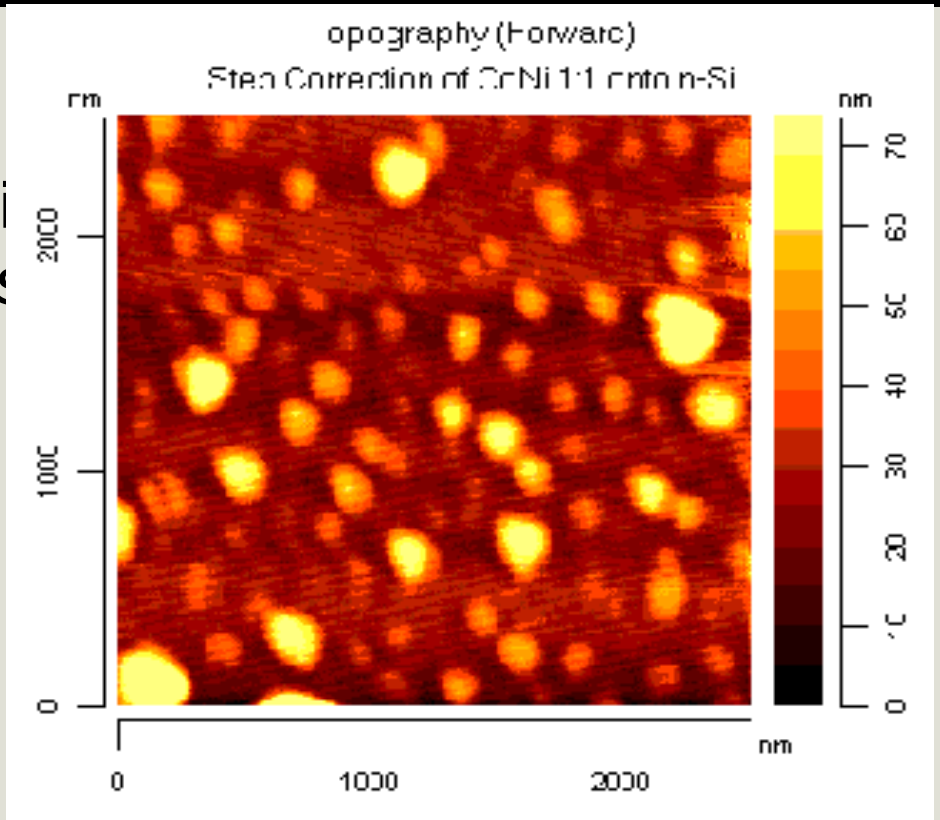
The MEMS' Team:

- Carlos Moina
  Nanotechnology materials i
  electrochemistry and mems
  applications (Magnetics
  nanoparticles)

(Surface process Centre)

- Gabriel Ybarra
  Conductive Polymer

(Surface process Centre)



Nanometer-sized nuclei of Co-Ni alloys were electrodeposited onto n-Si (100) electrodes

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