

## Theme-based objectives and endpoints

Studying physical mechanisms resulting from the application of the electrical field to solid, liquid and gaseous dielectrics.

Studying the materials used for electrical insulation of electrical engineering and electronic devices: behaviour under industrial constraints, durability, diagnostic methods, new materials.

Developing processes using electrostatic forces



## Scientific activities

### Characterization of dielectrics

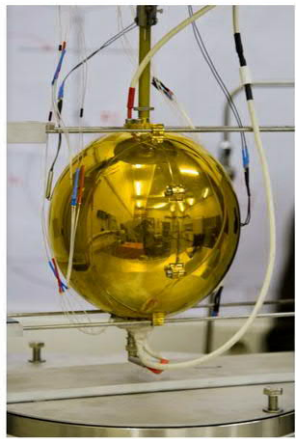
- Thin layers of oxides (Hafnium, MEMS)
- Thin layers of parylene (PPX N, C, D)
- Films of Biopolymers (PLA, PHBV, PCL)
- Insulating liquids under high temperature and high voltage (Fluorene)

### Pre-disruptive phenomena studies

- Multi-physic study of pre-disruptive phenomena in solids (Ageing)
- Gas insulation for transfer of energy under very high voltage (HVDC)
- Optical spectroscopy of discharge in liquids (Charges mobility)
- Induced phenomena in a liquid by a highly localized injection of energy (Thermodynamic model)

### Development of electrostatic processes and of specific techniques

- Energy harvesting through electrostatic process using Electro Active Polymers (EAP)
- Discharges in microgaps (MEMS)
- Electro-coalescence of water droplets in an insulating liquid (EC)
- Discharge based processes in liquids (Cleanup, Extraction)
- Calorimetry by thermal radiation: measurement of losses in power components (Measurement)



Loss measurement by calorimetry in power components



Measurements under high voltage in liquid Helium

## Experimental facilities and Achievements

### Very High Voltage Measurement

Marx Generator (500kV) / DC (360 kV) & AC (300 kVrms) high voltage power supply / steep waves impulse voltage generator / Measurement of losses, measurement of partial discharges

### Electrical and dielectric analysis

Low-voltage dielectric spectroscopy (1 μHz-10 MHz) and high voltage dielectric spectroscopy (1 mHz- 1 kHz/20 kVrms) / 4-point measurements / measurement of: weak current, surface potential, space charges in solids (LIPP &PEA) / resistivity meter for liquids

### Chemico-physical analyses

SEM, UV-visible spectrophotometer / FTIR / rheometer / Dynamic mechanical analysis (DMA)/ contact angle measurement/ drying oven, climate chamber, UV chamber, vacuum chamber

### Material and sample elaborations

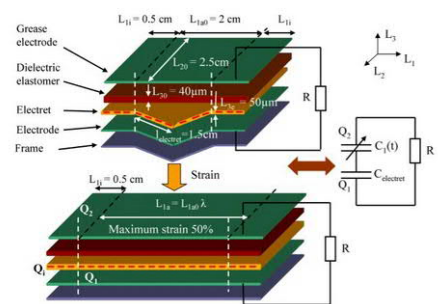
Sputtering and evaporation equipment for thin metallic film applications/ lapping machine

### Opticals

Spectroscopy (200-1000nm) / high-sensitivity rapid imaging / streak camera

### Specific devices

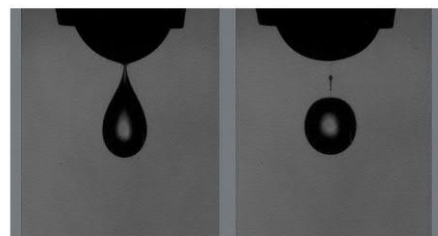
Cryostats 4.2 K/ high pressure and very high voltage test cells / calorimeter for losses in component



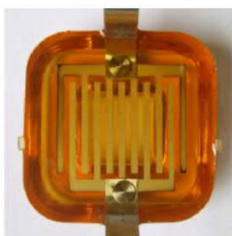
Design of electret-dielectric elastomer generator prototype: at rest and maximal state



HVDC 350 kV test cell for the measurement of dark currents through pressurized gases



Photos illustrating injection of a non-charged water droplet in a dielectric liquid (polybutene oil) generated by electrostatic pulse



Experimental model of an interface silica/resin studied with inter-digitated electrodes

## Collaborative projects

### University

Laboratories LAPLACE (Toulouse), IES (Montpellier), Pprime (Poitiers), LCEE (Poitiers), LPCML (Lyon), LMPB-IMP (Lyon), UTC (Compiègne), IMN (Nantes), LMSSMat (Ecole Centrale Paris), LaMCoS (INSA Lyon) Grenoble : LEGI, Institut Néel, LTM, CERMAV ...

University of Bucharest (Romania), Leicester (UK), Bizerte-Tunis (Tunisia), Western Ontario (Canada), Cordoba (Spain), University of Pennsylvania: Penn (USA), California State University at Northridge (USA), Northwest University of Xi'an (China) ...

### Corporate

Areva, EDF, Schneider Electric, CEA- LETI, Renault, ST Microelectronics, Alstom, EADS, Boréalís, Siemens, CTP, Nexans, Varioptic, Comelec...

### International

SINTEF (Norway), Joint Institute for High Temperatures (Institution of the Russian Academy of Sciences, Moscow, Russia), Institute of Mechanics (Sofia, Bulgaria),

