

The laboratory

The Laboratory of New Technologies is a lab of the IFSTTAR institute. Its proficiency concerns the power electronics applied to transport systems, traction applications (automotive and railway) and electric actuators (aircraft), with a technological approach of components (semi-conductors, ultra-capacitors, fuel cells,...). The global approach is to contribute to the knowledge of the behavior of new devices subjected to their usage conditions, to study their integration in the transport modes and to promote the development of electric and hybrid transport systems. It is involved in original research in the domain of the reliability testing of power semiconductor devices, the storage of electrical energy for urban transport systems and the integration and interface systems of fuel cell generators.

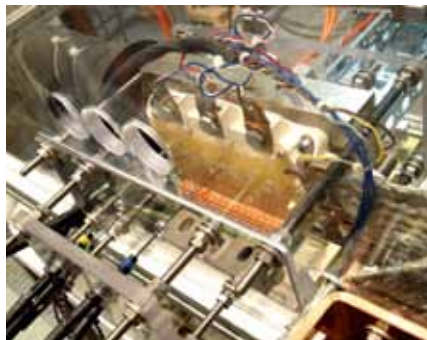


Key research fields

Robustness & Reliability of Power semiconductor devices and integrated systems

Investigations are especially conducted for

high voltage and high temperature power semiconductor devices and power modules. In this field, the research focus is in one hand the assessment of power devices lifetime and on other hand on the understanding of the physical mechanisms of degradation and aging phenomena of power IGBT modules and new wide band gap based semiconductor devices (SiC, GaN).



Reliability of Energy storage systems for transport applications (Ultra-Caps)

Works concern the behavior of ultra-cap devices and systems against ageing by successive charge and discharge cycles. The goal is the understanding of their behavior in usage conditions. Effects of test parameters (temperature, voltage, current, ...) are evaluated in order to highlight the key factors involved in failure modes and to control the reliability and security of the energy storage systems.

Fuel Cell generator systems for transport applications

The research activities conducted on fuel cell generators are closely linked with



actual contexts of electrical vehicle and reduction in greenhouse gas emission. The focus is done on experimentation and integration of fuel cell systems in the transport environment (characterization, performance improvement, endurance, reliability and diagnostics). It is also considered degradation modes and fault tolerance of fuel cells.

Competence areas

- Reliability testing (ageing tests by power cycling, thermal cycling)
- Search for ageing indicators (damage detection)
- Si (power IGBT modules) and WBG (SiC and GaN) devices
- Electrical characterization in high power range (4kV-6kA from -40°C to 125°C , 20A-6kV @ 250°C)
- Thermal characterizations (R_{th} , Z_{th} , transient thermal analyses,...)
- IR thermography
- Physics of failure (Failure analyses, failure mechanism investigations)
- Multi-physic modeling (electro-thermal, thermo-mechanical)