



Acoustic sensor for the measurement of in-reactor fission gas release.

Technology Presentation Summary

This technology, developed by the CEA and the Institute of Electronic Systems, allows real-time analysis of the composition of a gas in extreme conditions (high radiation, hazardous products , etc.) by using acoustic measurement of its molar mass.

Value added offer

The advantage of this acoustic technique is that it allows for an in-situ analysis without extraction or transfer of the measured gases.

An interesting feature of this sensor is that it was designed and tested for the on-line and real time measurement of fission gas release inside nuclear fuel rods.

Special signal processing was implemented to allow analysis even in disruptive conditions.

Challenges & Markets

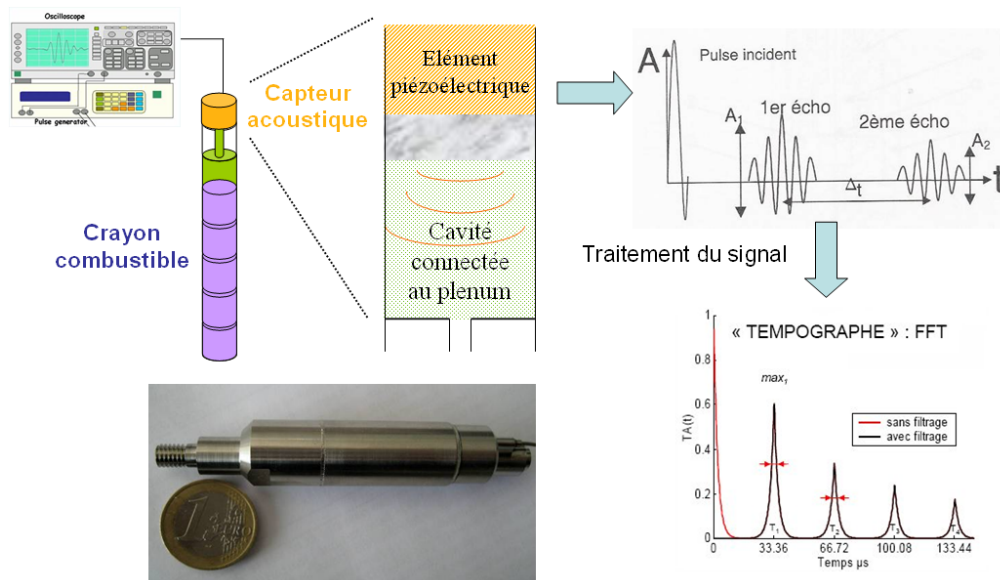
In its current version, the sensor is the only instrument in the world enabling scientists to carry out high-performance research programs aimed at improving our knowledge of the composition and kinetics of the gases released in nuclear fuels. This issue is of prime importance to the scientific and industrial world, especially in the field of fuel code modeling qualification of different reactor types.

Furthermore, this technology could be adapted to other similar applications in industrial or research environments

A Detailed Presentation of the Technology

The sensor, specifically designed for use in a nuclear reactor, contains a piezoelectric element that generates an acoustic wave in a cavity containing the gas to be analyzed.

The measurement of the acoustic speed in the gas enables us to determine its molar mass.



Its Technology Readiness Level (TRL)

TRL Level 7

Prototypes of these sensors have already been tested in real conditions, particularly at the time of the successful experimental program conducted in the OSIRIS reactor.

The current stages of development concern the perfecting of the general design (the piezoelectric element, acoustic damping and coupling...), improvement in the modeling and industrialization of the sensor. The manufacturing techniques and measurement methods implemented in this sensor can benefit the entire field of instrumentation in extreme environments.

Patents

Patent FR 293 440 filed July 24 2008, "Acoustic sensor for measuring a gas in a containment, comprising both a chamber and a sensor"

Technology Offer of the laboratory

- Nuclear radiation measurement
- Measurement of the in-reactor physical parameters (temperature, strains, physico-chemical aspects...)
- Detector modeling
- Design and manufacturing of the sensors for nuclear research and industry
- specific activity measurements of solid samples by gamma spectrometry and X rays
- (COFRAC accredited)

Laboratory Expertise

- Instrumentation in extreme environments
- In-reactor measurements
- Reactor dosimetry

Laboratory Equipement and Platforms

CEA Cadarache has major, large-scale test facilities and extensive development means:

- Workshop devoted to the manufacture of sensors (their design, development and the fabrication of fission chambers)
- The COFRAC accredited MADERE Platform for gamma spectrometry and X ray measurement of the specific activity of dosimeters.
- Accelerators / irradiators / generators
- Research reactors: EOLE, MINERVE...

Our strong point:

CEA Cadarache has several decades of expertise and know-how in the field of instrumentation that allow us to meet your needs.

Invested human resources in terms of R&D in the development of this particular technology: 2 research engineers

Accreditations:

- ISO 9001 Certification
- ISO 14001 Certification
- OHSAS
- COFRAC Test for the measurement of specific activity in solid samples.