



Coef h[®] : sensor and software for measuring the heat transfer coefficient

Technology abstract presentation

CEA Coef h technology allows, thanks to a specific high dynamic sensor and a dedicated data processing software, to provide, in steady state and unsteady state, all the thermal essential measurements to characterize a heat transfer between a flow (liquid or gas) and a wall: fluid and wall temperatures measured at different distances from the wall, heat flow and wall temperature (at the interface), heat transfer coefficient.



Fields of application (nuclear and non-nuclear)

CEA Coef h technology is dedicated to all industrial sectors, including:

- mixing zones in pipes (i.e mixing tees)
- braking systems
- motorization, aerodynamics
- buildings' energy efficiency
- heat exchangers design
- pipes fouling and clogging measurement and monitoring (geothermal, oil drilling, district heating, etc.),
- mechanical parts friction study
- space area

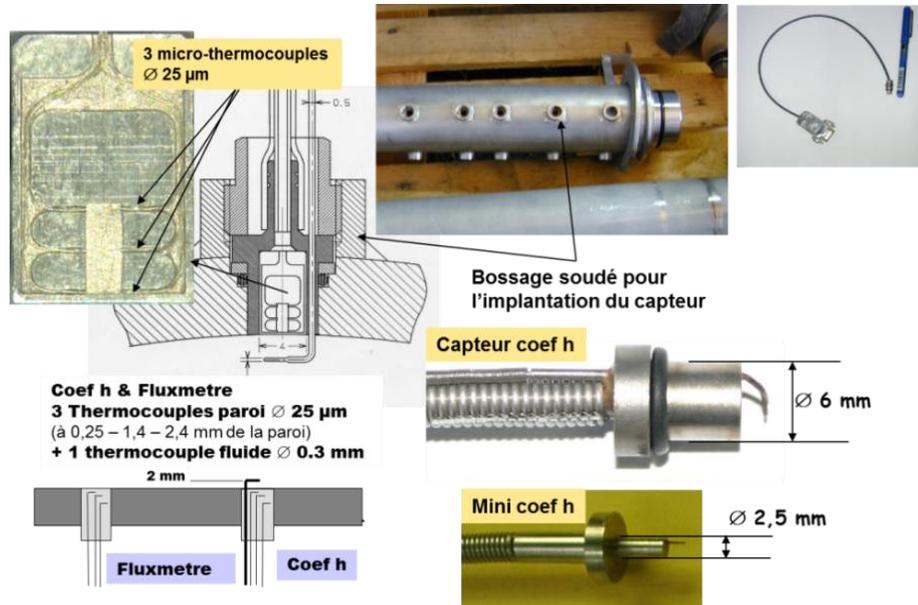
Technology competitive benefits and advantages

The Coef h software, associated to the sensor, brings the "turnkey" aspect of the solution. Adding a plug-in solution makes it possible to adapt to the specific characteristics of each application domain:

- adaptation of the sensor to the desired material and dynamics,
- adaptation to owner data formats,
- adaptation to calculation methods and specific units
- adaptation to specific visualization methods application

The CEA sensor coef h manufactured and marketed

The coef h sensor concentrates inside a small body three micro-TCs ($\varnothing 25 \mu\text{m}$) welded and one external TC ($\varnothing 0.3 \text{ mm}$) for measuring the temperature in the fluid. To minimize the thermal bias, the coef h sensor is made of the same material as the wall (steel, concrete, ...) giving it a strong adaptability.



The coef h sensor can be redesigned and manufactured case by case to be adapted and meet the specific needs of each customer.

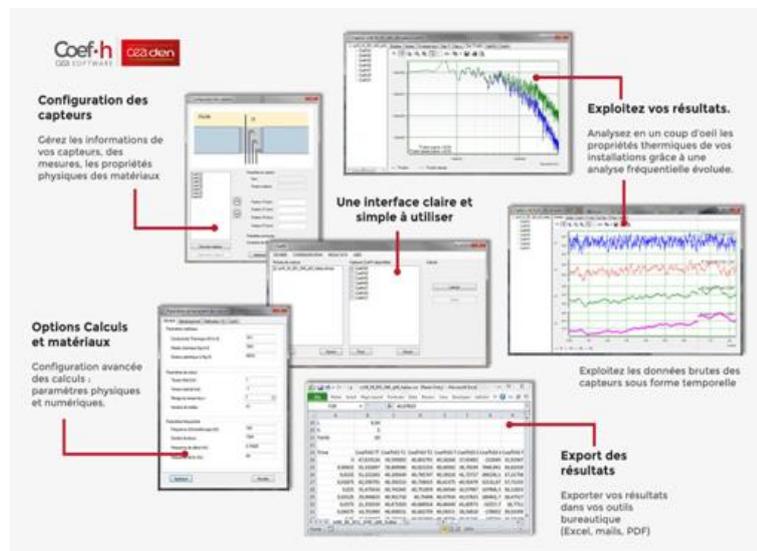


www.kayme.eu

Range of use of CEA sensor coef h

- Calculation pressure: 250 bar (peak at 400 bar)
- Calculation temperature: 400-710 ° C

The software Coef H CEA software developed and distributed by HALIAS TECHNOLOGIES under CEA license



The CEA Software coef-h graphical software allows to analyze the exchange coefficient measured by the sensor, in time mode or in frequency mode.

Additional modules can be developed on a case-by-case basis to meet the specific needs of each client.

HALIAS TECHNOLOGIES www.halias.fr

<http://coefh.cea-software.com/>

TRL maturity level of technology

TRL Coef h: 8-9

Specific developments, still to be carried out, concern:

- algorithm calculation adaptation to some particular application domains (oil & gas, aeronautics, etc.),
- additional modules can be developed on a case-by-case basis to meet the specific needs of each client,
- a software deployment in supervision mode is possible (for example, critical fouling anticipation).

Intellectual Property (Patent, App Filings, Trademarks, ...)

The "coef h sensor" technology is protected by a CEA - Cadarache patent (FR2940435B1) expiring in 2028. A file has been sent to APP by the CEA, to which the software belongs. It has been rewritten for the CEA by HALIAS Technologies in order to make it usable in industrial context. A distribution license was granted to HALIAS Technologies in 2017. A sensor marketing license is granted to Kayme since 2011.

Service and partnership offers

- Sale of expertise services to analyze industrial issues in the measurement of heat exchange coefficient and materials' thermal fatigue.
- License to use the software marketed by Halias Technologie
- Training sales of Coef h software use
- Collaboration agreement for specific applications and developments: re-design of coef h sensor and development of specific software modules to meet specific needs

They trust us:

CEA Coefh technology has been developed in partnership with the instrumentation company KAYME (for the sensor) and the industrial computer company HALIAS TECHNOLOGIE (software for providing the sensor output data).

A collaborative partnership is underway with the Renault / Nissan Alliance to implement coef h technology on braking systems