Profile SFR-19

LIQUIDUS

FRANCE

GENERAL INFORMATION

NAME OF THE FACILITY	LIQUIDUS
ACRONYM	LIQUIDUS
COOLANT(S) OF THE FACILITY	Sodium
LOCATION (address):	CEA Cadarache, 13108 Saint Paul Lez Durance FRANCE
OPERATOR	CEA
CONTACT PERSON (name, address, institute, function, telephone, email):	O. GASTALDI CEA Cadarache Building 208, 13108 Saint Paul Lez Durance, FRANCE Sodium Technology and Components Project Manager +33 4 42 25 46 40 Olivier.gastaldi@cea.fr
STATUS OF THE FACILITY	In operation
Start of operation (date):	Since 2008 for sodium operation. Existing since 2003 but operated with PbBi eutectic

MAIN RESEARCH FIELD(S)

- ☐ Zero power facility for V&V and licensing purposes
- ☐ Design Basis Accidents (DBA) and Design Extended Conditions (DEC)
- ☐ Thermal-hydraulics
- ☐ Coolant chemistry
- ☒ Materials
- ☐ Systems and components
- ☒ Instrumentation & ISI&R

TECHNICAL DESCRIPTION

Description of the facility

The LIQUIDUS sodium facility is an experimental device to be used for studying the transmission of ultrasonic waves at a solid material – liquid sodium interface.

The main component of this device is a glove box with a volume of around 400 litres fitted with an airlock. A pot containing 3 litres of sodium whose temperature can be increased up to 500°C is installed inside the containment. Two cylindrical metal bars made of 316L steel, referred to as waveguides, are

used for conveying the ultrasonic waves.

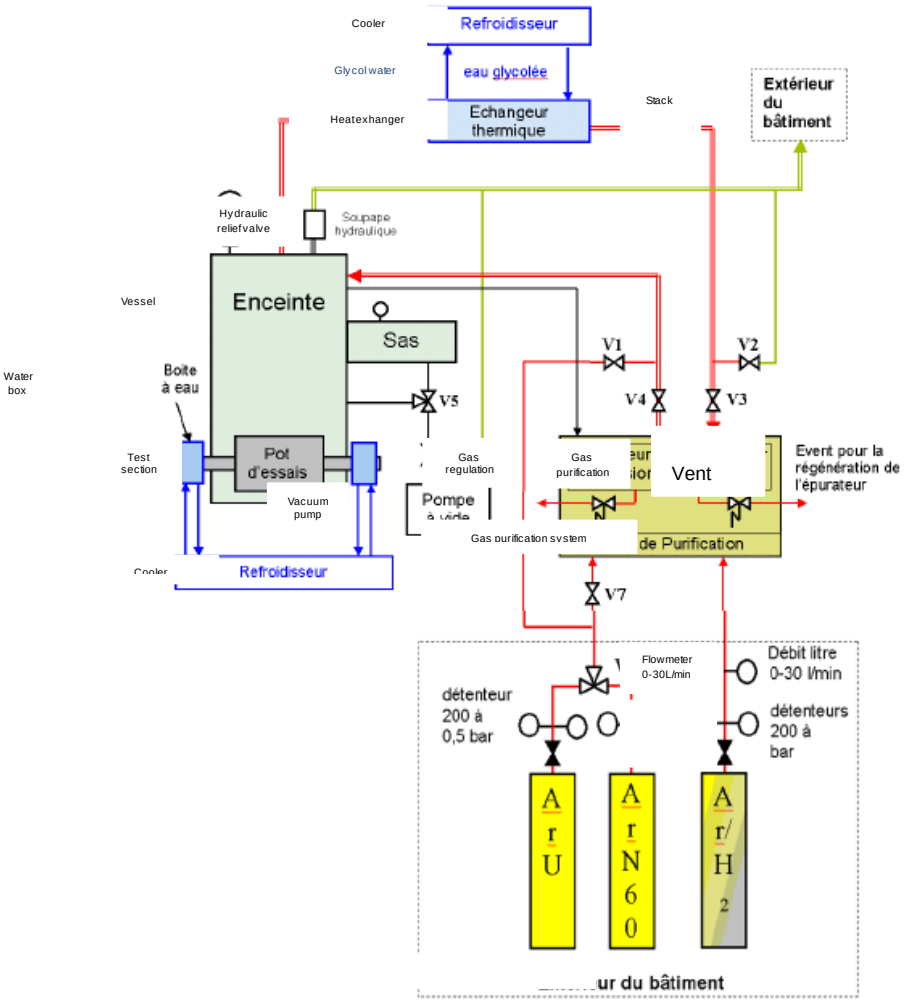
The guides are used for transmitting, in the liquid sodium test pot, the ultrasounds emitted and received by traditional ultrasonic transducers located outside the glove box at ambient temperature. The advantage of the waveguides is that they can be employed for performing ultrasonic experiments in liquid sodium at temperatures up to 500°C without having to implement transducers capable of withstanding such conditions.

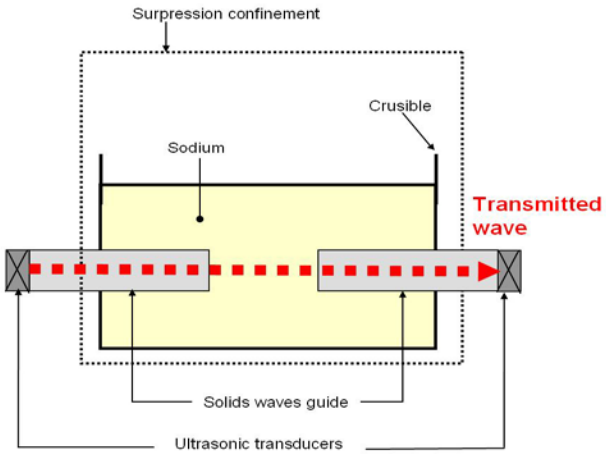
Each waveguide is cooled by a heat exchanger positioned outside the glove box allowing to reach 40°C at the outside extremity of the waveguides. A gas purification unit is employed for reducing oxygen and humidity concentrations down to 1 ppmV under argon, which is used as cover gas.

Acceptance of radioactive material

No

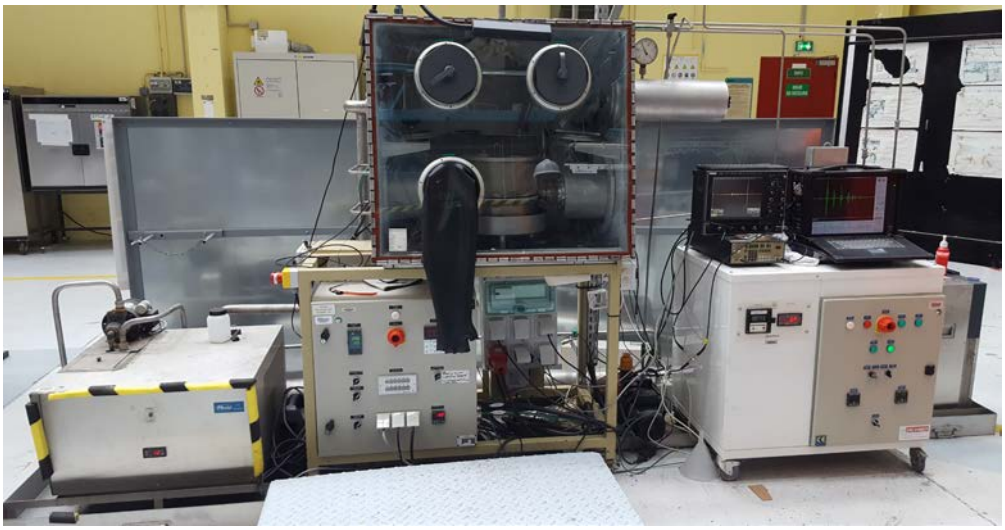
Scheme/diagram

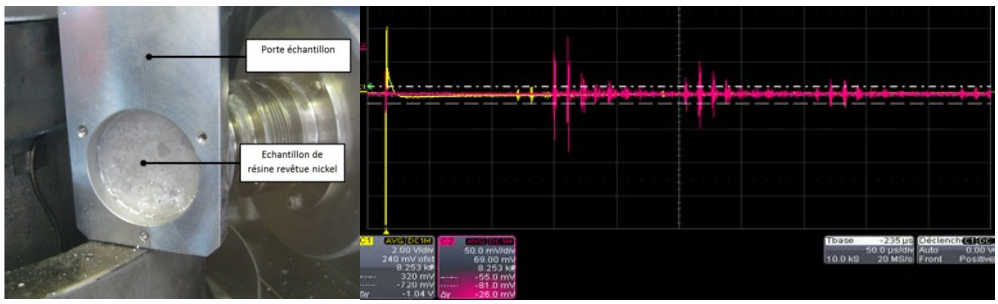




Schematic view of the acoustic part of Liquidus sodium test section

3D drawing/photo





Parameters table

Coolant inventory	3 L of sodium
Power	Around 3 kW
Test sections	
TS #1	*Characteristic dimensions* Inner diameter of sodium pot: 210 mm
	Static/dynamic experiment Static
	Temperature range in the test section (Delta T) 110°C to 500°C
	Operating pressure and design pressure 0,5 mbar < operating pressure < 4 mbar
	Flow range (mass, velocity, etc.) N.A.
Coolant chemistry measurement and control (active or not, measured parameters)	No coolant purification except manual skimming. Argon (cover gas) purification unit allowing to reach high gas quality (< 1 vpm oxygen and moisture)
Instrumentation	Temperature measurement in sodium Pressure measurement in gas Oxygen and humidity measurement in gas Ultrasound transmission and reflection measurement

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

Within the framework of the development of immersed ultrasound transducers operating in sodium, one major challenge is to obtain the sodium wettability of the emitting surface of the transducer at relatively low temperature (200°C). Then different samples were used to determine their ability to obtain a good acoustic coupling between solid and liquid sodium. These samples are

- Made of different materials: stainless steel, resins …
- With different roughness surface
- And potentially with different coating materials

It was shown that the presence of gas pocket can have a major effect on the obtained coupling results. Of course the level of temperature also plays a key role.

PLANNED EXPERIMENTS (including time schedule)

In 2015 and 2016, a new experimental campaign will be realized on metallic sample with a specific surface preparation.

TRAINING ACTIVITIES

Possible, but no specific program is planned.

REFERENCES (*specification of availability and language*)

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