

## Profile LFR-8

### LIMETS2

### BELGIUM

#### GENERAL INFORMATION

NAME OF THE FACILITY LIquid METals Test Stand 2  
ACRONYM LIMETS2  
COOLANT(S) OF THE FACILITY Lead-Bismuth Eutectic (LBE)  
LOCATION (address): SCK•CEN, Boeretang 200, 2400, Mol, Belgium  
OPERATOR SCK•CEN  
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#### STATUS OF THE FACILITY

Start of operation (date):

In operation

#### 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

LIMETS2 is an experimental set-up designed for mechanical testing of materials in an LBE environment in order to investigate mechanisms and kinetics of material/liquid metal interactions that influence mechanical properties of the material. LIMETS2 is a copy of LIMETS1 but it is housed in a hot-cell in the Laboratory for High and Medium Activity. This allows LIMETS2 to accept radioactive irradiated samples including  $\alpha$  (Po) contaminated samples. The vessel consists of an autoclave in which the experiments are performed and a dump tank. Oxygen controlled via a gas flow of an adjustable argon Hydrogen mixture with an  $H_2$  concentration of up to 20%. Oxygen control can be performed in both the autoclave and the dump tank. Each of these are equipped with two Bi/BiO<sub>2</sub> oxygen sensors. The autoclave houses a mechanical testing device that can be operated in a gas atmosphere or under stagnant LBE. Possible tests include tensile tests, fracture toughness tests, slow strain rate tests, constant load tests and crack growth rate experiments. The maximum load of the device is 20kN and the displacement rates range between  $3 \cdot 10^{-6}$  to  $9 \cdot 10^{-2}$  mm/s. The maximum displacement is 30 mm. The temperature range is from 550°C down to room temperature. Obviously, below the melting point of the coolant only experiments in a gas atmosphere are possible.

### Acceptance of radioactive material

Yes

### Scheme/diagram

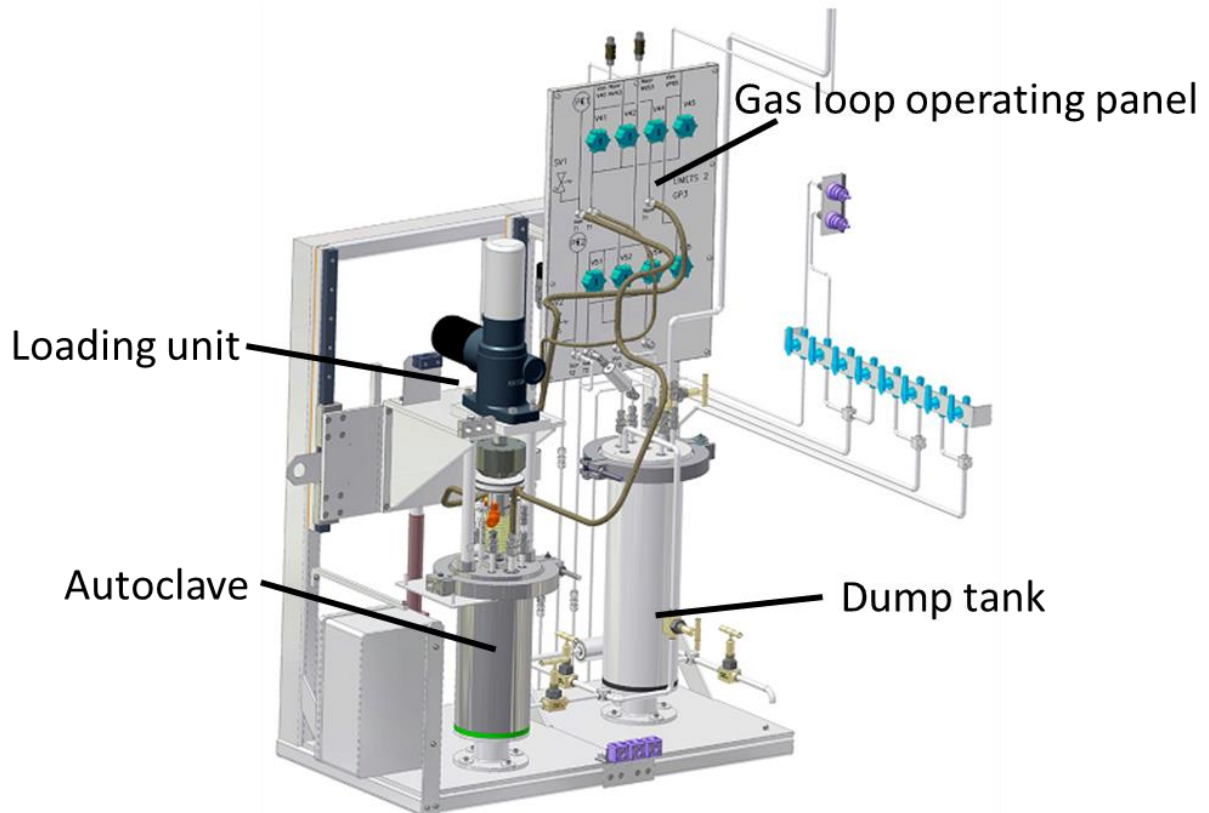


FIG. 1. Scheme of the LIMETS2 facility

### 3D drawing/photo

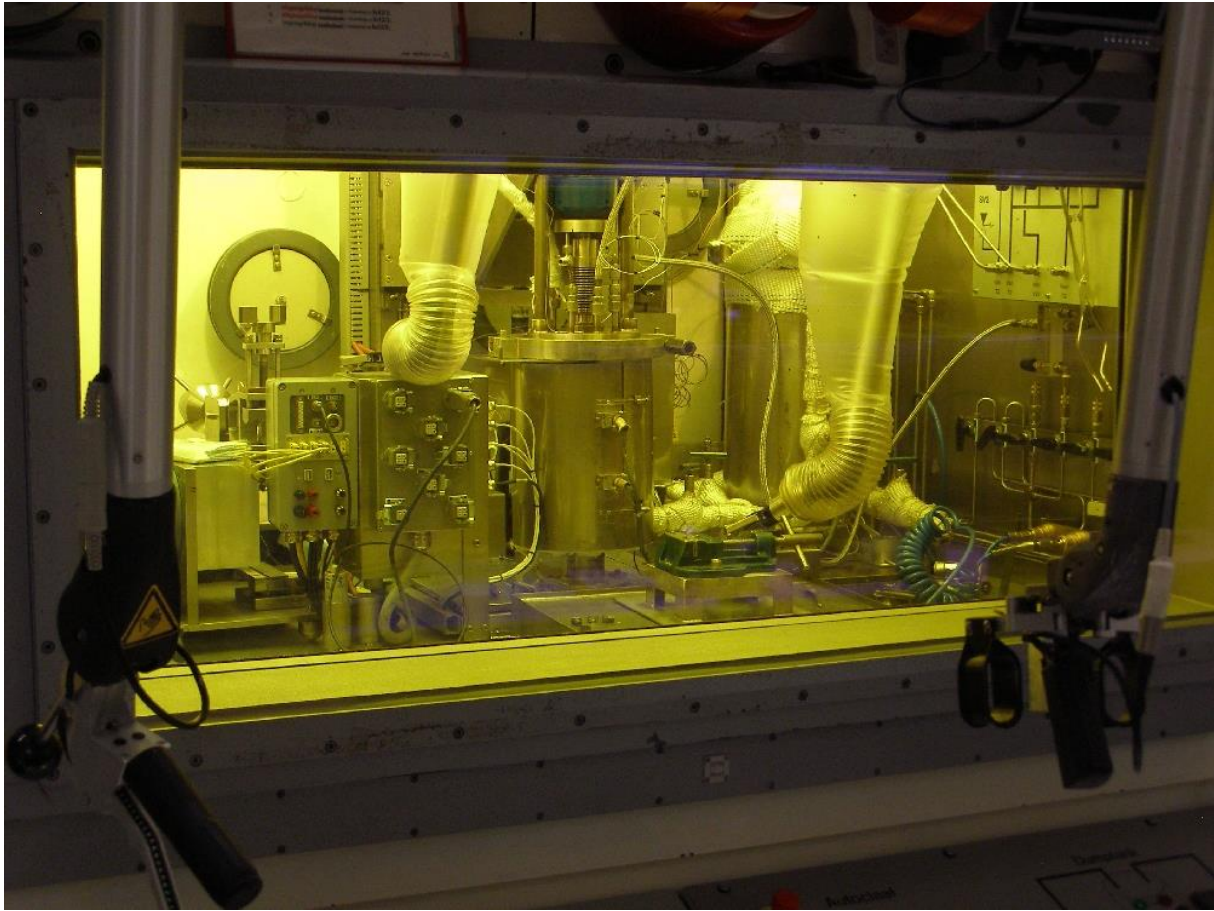


FIG. 2. View of the LIMETS2 facility

### Parameters table

Coolant inventory	3,6 l
Power	3,5 kW
Test sections	
TS #1	<u>Characteristic dimensions</u> φ15 cm x 20 cm
	<u>Static/dynamic experiment</u> Static
	<u>Temperature range in the test section (Delta T)</u> 550°C-RT
	<u>Operating pressure and design pressure</u> <b>4 bar</b>
	<u>Flow range (mass, velocity, etc.)</u> Stagnant LBE
Coolant chemistry measurement and control (active or not, measured)	Oxygen control via controlled gas flow Ar, Ar+5% H <sub>2</sub> , Ar+20% H <sub>2</sub> . Double set of Bi/BiO <sub>2</sub> sensors installed in both tanks

parameters)	
Instrumentation	Thermocouples, Oxygen sensors, Direct measurement of displacement on specimens, strain rate, load and frequency.

## **COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS**

LIMETS 2 was used in the MYRRHA materials qualification programme and for EU projects including FP6-EUROTRANS-DEMETRA. The device is only employed to investigate irradiated samples. In LIMETS-2 an assessment of Liquid metal embrittlement (LME) of austenitic and ferritic martensitic steels in LBE was made on samples irradiated in the BR2 test reactor.

## **PLANNED EXPERIMENTS (including time schedule)**

At the moment LIMETS-2 is in standby.

## **TRAINING ACTIVITIES**

Training activities are possible, availability allowing and after prior agreement under supervision of SCK•CEN Qualified staff.

## **REFERENCES (*specification of availability and language*)**

1. VAN DEN BOSCH J., COEN G., BOSCH R.W., ALMAZOUZI A. "TWIN ASTIR: First tensile results of T91 and 316L steel after neutron irradiation in contact with liquid lead–bismuth eutectic" Journal of Nuclear Materials 398 (2010) 68–72