

## Profile LFR-11

**MEXICO**

**BELGIUM**

### GENERAL INFORMATION

NAME OF THE FACILITY                      Mass EXchanger In Continuous Operation  
ACRONYM    MEXICO  
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**                      In operation  
Start of operation (date):                      2014

**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 main purposes of the MEXICO loop are: a) to develop oxygen control systems for regulating dissolved oxygen in liquid lead-bismuth eutectic (LBE) ; b) to evaluate filtration systems for purifying the LBE; c) to validate numerical model of oxygen mass transfer in LBE.

In order to achieve the purposes, MEXICO loop designed to be operated with three temperature zones. There are two test sections in medium and hottest temperature zone, in which oxygen control systems such as gas phase, solid oxide phase and electrochemical oxygen pumping system, can be tested.

Two filter housings are located in the lowest temperature zone of the loop. Thus, not only suspended solid impurities but also dissolved impurities are expected to be separated from the liquid LBE by cold trapping. The efficiency and expected life time of those filter systems will be evaluated.

A total of 23 potentiometric oxygen sensors were installed at various positions from highest temperature to lowest temperature to monitor the oxygen mass transfer throughout the loop in order to monitor the change of the oxygen concentration through entire loop.

**Acceptance of radioactive material**

No

**Scheme/diagram**

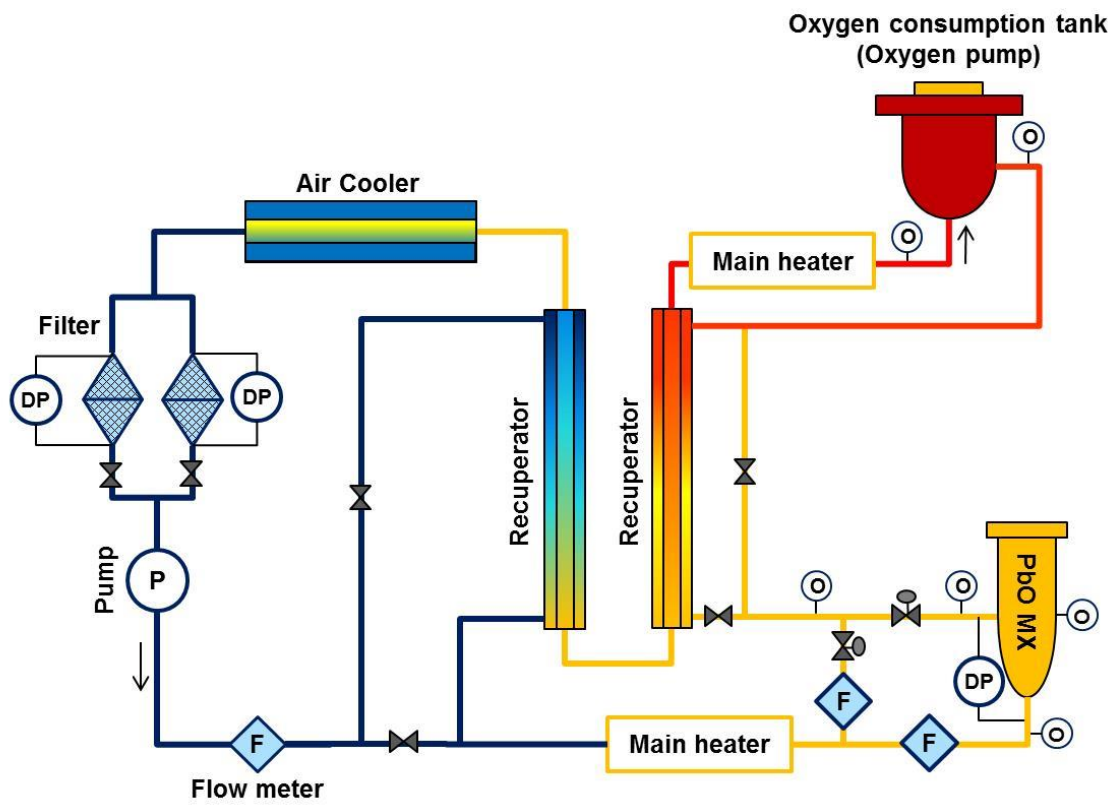


FIG. 1. Scheme of the MEXICO facility

3D drawing/photo

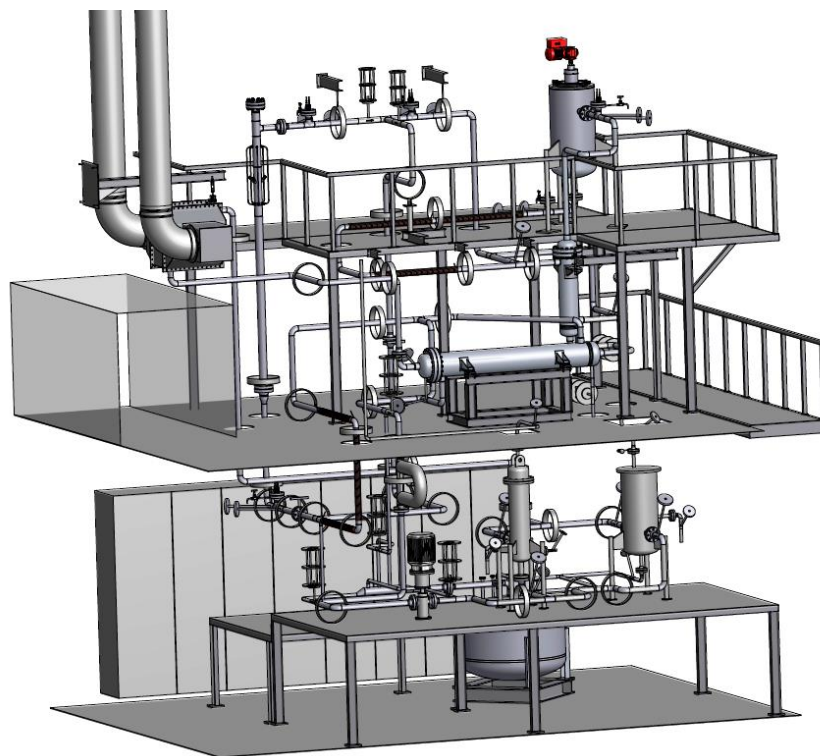


FIG. 2. View of the MEXICO facility

### Parameters table

Coolant inventory	7000 kg
Power	120 kW
Test sections	
TS #1	<u>Characteristic dimensions</u> ASTM 3 inch pipe, L= 3000 mm
	<u>Static/dynamic experiment</u> Dynamic experiment for oxygen control systems in a loop type configuration
	<u>Temperature range in the test section (Delta T)</u> 200-450°C
	<u>Operating pressure and design pressure</u> Operating pressure: 1-3bar, Design pressure : 10 bar
	<u>Flow range (mass, velocity, etc.)</u> Up to 10kg/sec
TS #2	<u>Characteristic dimensions</u> ID= 500 mm, Height = 1200 mm
	<u>Static/dynamic experiment</u> Dynamic experiment for oxygen control systems in the pool
	<u>Temperature range in the test section (Delta T)</u> 200-450°C
	<u>Operating pressure and design pressure</u> Operating pressure: 1-3bar, Design pressure : 10 bar
	<u>Flow range (mass, velocity, etc.)</u> Up to 10kg/sec
Coolant chemistry measurement and control (active or not, measured parameters)	Active oxygen control and monitoring
Instrumentation	Oxygen sensor, differential pressure gage, flow meter

### COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

- Oxygen control by venturi type PbO mass exchanger (MX)

The oxygen controllability of a venturi type PbO MX has been tested in the MEXICO loop. The dissolution rate of PbO MX was controlled by regulating the flow rate over the PbO MX. In order to regulate the flow rate, the opening of a control valve positioned at the outlet of PbO MX was controlled by a PID controller based on the difference between target oxygen concentration and measured oxygen concentration. During the test, temperature was regulated to be 210°C, 320°C and 430°C in cold, intermediate, hot zone, respectively. The total LBE flow rate was 3 kg/sec. Highly accurate oxygen control was achieved by the oxygen control system under the condition as shown in FIG. 3.

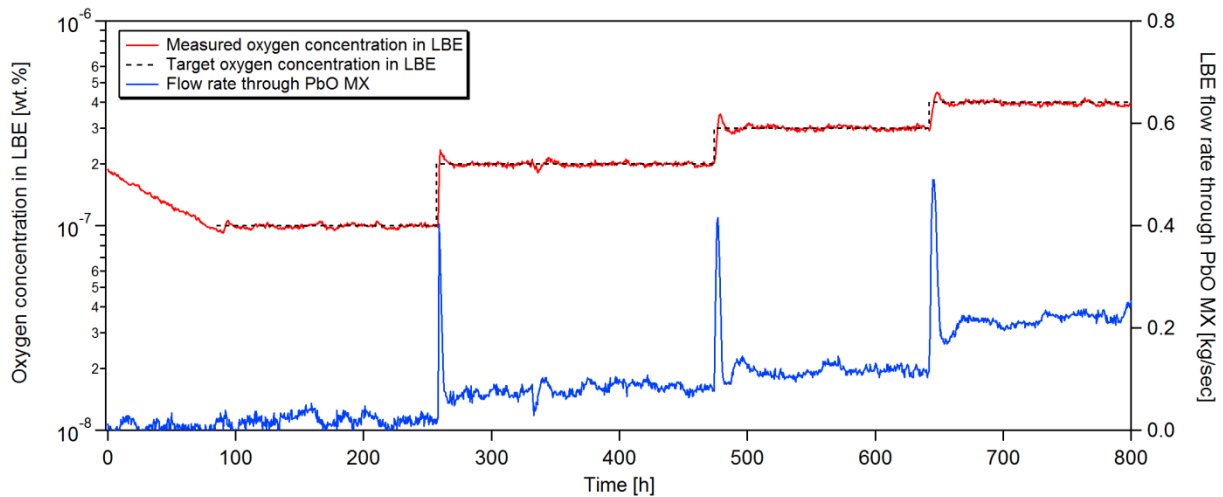


FIG. 3. Control of dissolved oxygen concentration in LBE by PbO MX in MEXICO loop

### PLANNED EXPERIMENTS (including time schedule)

In the next two years (2015-2016) the MEXICO loop is planned to be used for the evaluation of the filtration and cold-trap purification system that serves as a prototype for the filtration system of MYRRHA. In parallel tests of the electrochemical oxygen pumping system are planned for 2015 while experiments with the gas phase oxygen reduction system are foreseen for 2016.

### 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*)