Profile LFR-69

SFLM

SPAIN

GENERAL INFORMATION

NAME OF THE FACILITY	Small facilities for LM corrosion tests. Stagnant and natural convection
ACRONYM	SFLM
COOLANT(S) OF THE FACILITY	Molten lead-bismuth eutectic and lead
LOCATION (address):	CIEMAT (Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas). Avenida Complutense 40. 28040 Madrid, Spain
OPERATOR	CIEMAT
CONTACT PERSON (name, address, institute, function, telephone, email):	Francisco Javier Perosanz. Avenida Complutense 40. 28040 Madrid. CIEMAT, Structural Materials Division, Corrosion Unit Head +34 913460876, franciscojavier.perosanz@ciemat.es

STATUS OF THE FACILITY	In operation
Start of operation (date):	2000

MAIN RESEARCH FIELD(S)	Natural convection loop for materials corrosion tests, and crucibles for static tests.

TECHNICAL DESCRIPTION

Description of the facility

Autoclaves: Six stagnant autoclaves (Figures 1, 2) suitable to contain, each of one, six crucibles of 40 mm diameter and 60 mm height. Each crucible contains one steel specimen and 350 g of lead–bismuth eutectic, or lead. The devices are equipped with thermocouples and with oxygen sensors to measure the content of oxygen introduced via the gas phase, in the molten lead–bismuth. The gas flow rate is approximately 200 cm3/min.

Furnaces: The experimental setup consists of a quartz tube in which several alumina crucibles can be placed (Figures 3, 4). The equilibrium H2/H2O is used to get the required oxygen partial pressure.

Small natural convection loops: This type of loop is constructed with stainless steel tube AISI 316L and 3/4" diameter (Figure 5). The dimensions are 650 mm x 650 mm, with two small tanks. One of them, in the hot leg, contains the specimens to be tested. The other, in the cold leg, is used as expansion tank and to inject gas (Ar+O2). The heating and cooling of the loop produce temperatures of 550ºC in the hot leg and 250ºC in the cold leg, which permit the natural circulation of the liquid metal. Different loops can be constructed on demand.

Acceptance of radioactive material
No

FIG. 1. Stagnant autoclaves

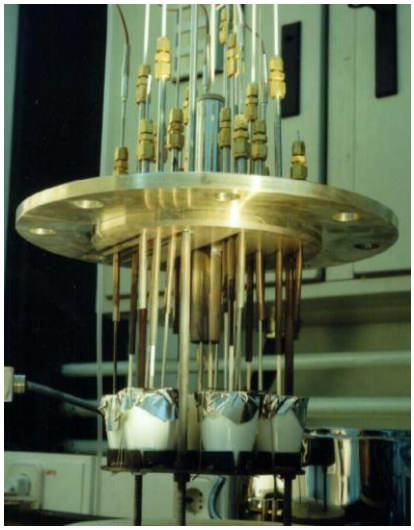

FIG. 2. Crucibles in stagnant autoclave

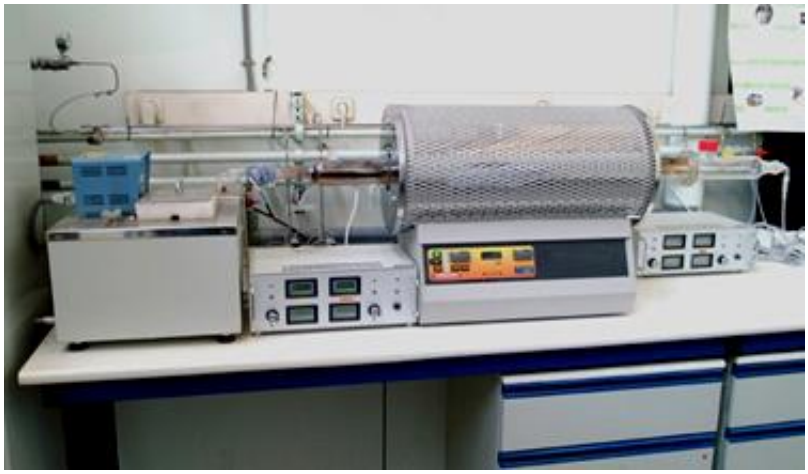

FIG. 3. View of the furnace.

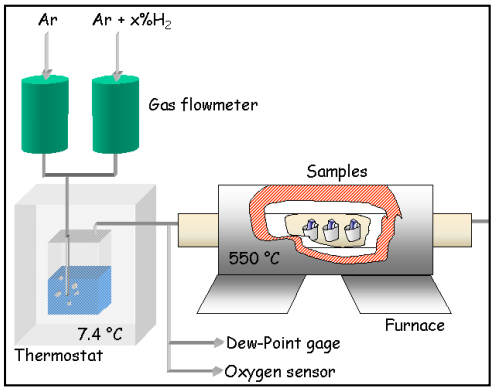

FIG. 4. Scheme of the furnace.

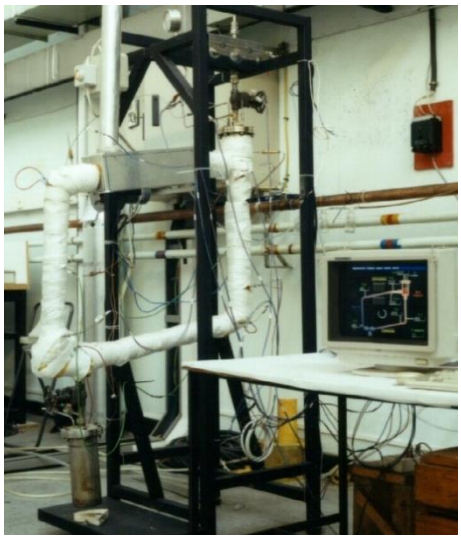

FIG. 5. Natural convection loop.

Parameters table

Coolant inventory	Max LBE inventory → 2200 kg
Power	235 kW
Test sections	
	Characteristic dimensions

	Outside pipe diameter 60 mm Overall height → 2200 mm Active length 600 mm Difference in height between FPS and HX 5 m
	Static/dynamic experiment Dynamic
	Temperature range in the test section (Delta T) 150°C trough the FPS
	Operating pressure and design pressure Operating Pressure → 8 bar (gauge) Design pressure → 10 bar (gauge)
	Flow range (mass, velocity, etc.) 0-7 kg/s maximum velocity in the fuel bundle of about 1 m/s
Coolant chemistry measurement and control (active or not, measured parameters)	Oxygen sensors are used to control oxygen concentration. Gas or H2/H2O equilibrium is used to fix the required oxygen concentration
Instrumentation	Thermocouples, pressure transducer, Gas injection system, Induction flow meters.

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

See references

PLANNED EXPERIMENTS (including time schedule)

TRAINING ACTIVITIES

REFERENCES (*specification of availability and language*)

1. MATTER Project .Deliverable D3.6 (Liquid Metal Corrosion).
2. MATTER Project .Deliverable D3.4 (Round Robin Exercise of Corrosion Testing in Liquid Metals (Pb, LBE)).
3. MARTÍN-MUÑOZ F.J., SOLER-CRESPO L., GÓMEZ-BRICEÑO D. Assessment of the influence of surface finishing and weld joints on the corrosion/oxidation behaviour of stainless steels in lead bismuth eutectic.. Journal of Nuclear Materials, 416, pp. 80-86 (2011).
4. SOLER L. et al., "Corrosion of stainless steels in lead-bismuth eutectic up to 600ºC", Journal of Nuclear Materials, 335, pp. 174-179 (2004).
5. MARTÍN F.J. et al., "Oxide layer stability in lead-bismuth at high temperature", Journal of Nuclear Materials, 335, p. 194-198 (2004).
6. GÓMEZ-BRICEÑO D. et al., "Influence of temperature on the oxidation/corrosion process of F82Hmod. martensitic steel in lead-bismuth", Journal of Nuclear Materials, 303, pp. 137-146 (2002).