Profile LFR-31

COSTA

GERMANY

GENERAL INFORMATION

NAME OF THE FACILITY	Corrosion Test Stand for Stagnant Liquid Lead Alloys
ACRONYM	COSTA
COOLANT(S) OF THE FACILITY	PB, LBE
LOCATION (address):	Karlsruhe Institute of Technology (KIT) Institute for Pulsed Power and Microwave Technology (IHM) Hermann-von-Helmholtz-Platz 1, Bldg 630 76344 Eggenstein-Leopoldshafen Germany
OPERATOR	KIT
CONTACT PERSON (name, address, institute, function, telephone, email):	Dr. Georg Müller Karlsruhe Institute of Technology (KIT) Deputy Institute Director +49 721 608 24669 georg.mueller@kit.edu

STATUS OF THE FACILITY In operation
Start of operation (date): 1997

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

COSTA test stands allow the exposure of more than 100 specimens at different temperatures from 300°C to 900°C and oxygen activities from reducing to saturation conditions simultaneously.

The specimen reactor is a quartz tube inside a furnace that is controlled at 550°C. A mixture of Ar and Ar +5%H2 allows the adjustment of the hydrogen concentration in the gas. The water vapor is added by passing the gas through water of a defined temperature. The maximum hydrogen

concentration that can be introduced is 5%, which is high enough and well below the lower explosion limit.

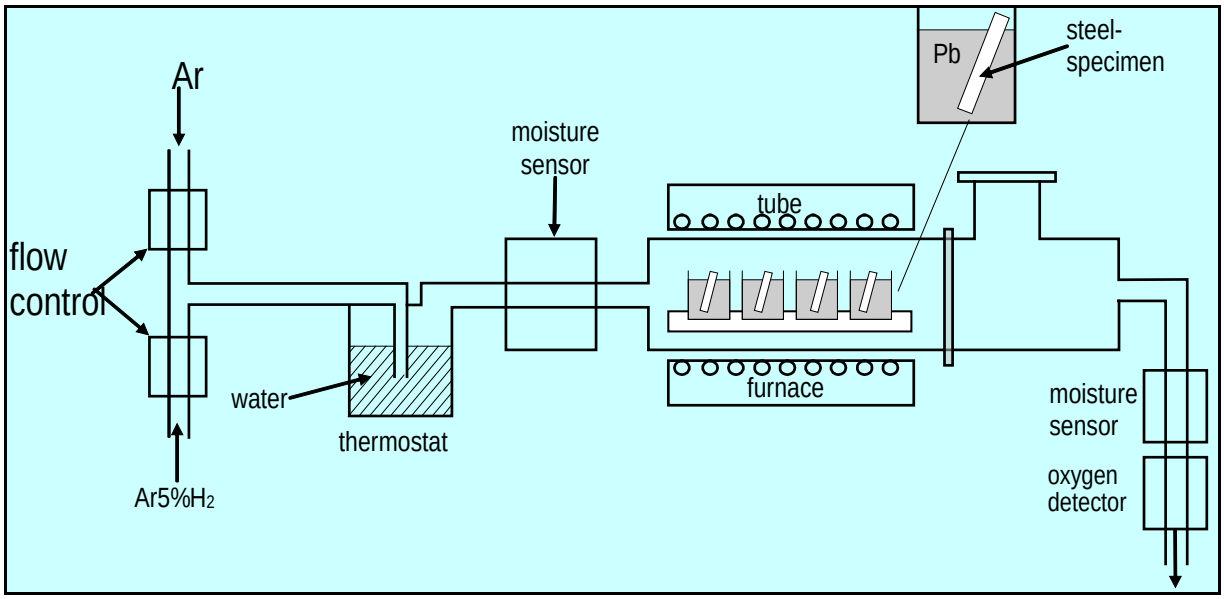
The lead in the furnace is stagnant and contains 10 crucibles which can take 10 metal specimens. Each crucible is filled with 40 g of high purity lead. The ratios of gas flows are controlled and the partial pressure of water vapor is measured before and behind the furnace. The gas passes also through an oxygen partial pressure measuring system after leaving the furnace.

Main research interest of COSTA is:

- Investigation of corrosion mechanisms
- Influence of protection layers and coatings on corrosion
- Investigation of GESA treated surfaces
- Influence of surface alloying on corrosion.

Acceptance of radioactive material
No

Scheme/diagram



3D drawing/photo

Parameters table

Coolant inventory	Up to 10 small alumina crucibles filled with LM in each furnace (furnace in total with 2 different oxygen partial pressures each)
Power	n/a
Test sections: 10	
TS #1-10	*Characteristic dimensions* Sample size:30x10x1 – can be slightly adapted 10 alumina crucibles in one half of furnace
	Static/dynamic experiment static
	Temperature range in the test section (Delta T) up to 900°C isothermal
	Operating pressure and design pressure ambient
	Flow range (mass, velocity, etc.) n/a
Coolant chemistry measurement and control (active or not, measured parameters)	Oxygen control via gas phase Gas phase oxygen and humidity is controlled Small oxygen sensor for the liquid metal under development
Instrumentation	Temperature Gas phase oxygen humidity

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

FeCrAlY development for cladding materials

T91, 316L at temperatures between 400 and 600°C

ODS steels in cooperation with JAEA

Maxphases, FeCrAl+RE, 316L, coatings and ODS steels

Model AFA alloys and model alumina forming HEA

PLANNED EXPERIMENTS (including time schedule)

Corrosion tests of Maxphases, FeCrAl+RE, 316L, coatings and ODS steels

and model AFA and alumina forming HEA

austentic steels with alloyed or modified surfaces

TRAINING ACTIVITIES

Training activities are possible, depending on availability and after prior agreement under supervision of KIT.

REFERENCES (*specification of availability and language*)

G. Müller, A. Heinzel, G. Schumacher, A. Weisenburger, Control of oxygen concentration in liquid lead and lead–bismuth, Journal of Nuclear Materials 321 (2003) 256–262

G. Müller, A. Heinzel , J. Konys , G. Schumacher, A. Weisenburger, F. Zimmermann, V. Engelko, A. Rusanov, V. Markov, Behavior of steels in flowing liquid PbBi eutectic alloy at 420–600 °C after 4000–7200 h, Journal of Nuclear Materials 335 (2004) 163–168

To be updated