

Profile LFR-30

CORRIDA

GERMANY

GENERAL INFORMATION

NAME OF THE FACILITY Corrosion in dynamic alloys
ACRONYM CORRIDA
MEDIUM (COOLANT(S)) OF THE FACILITY Lead–bismuth eutectic
LOCATION (address): Karlsruhe Institute of Technology (KIT)
Hermann-von-Helmholtz-Platz 1
Bldg. 415
76344 Eggenstein-Leopoldshafen
Germany
OPERATOR Liquid Metal Technology Group of the Institute for Applied Materials
-Applied Materials Physics (IAM-AWP)
CONTACT PERSON(S) (name, address, institute, function, telephone, email): Dr. Carsten Schroer
Karlsruhe Institute of Technology (KIT)
Institute for Applied Materials -Applied Materials Physics (IAM-AWP)
Head of Liquid Metal Technology Group
+49 721 608 24840
carsten.schroer@kit.edu

STATUS OF THE FACILITY In operation
Start of operation (date): 2003

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

CORRIDA is a forced-convection loop for investigating corrosion of steels in flowing lead–bismuth eutectic (LBE) at temperatures between 400 °C and 550 °C. The concentration of oxygen dissolved in the circulating LBE is controlled with the aid of gas/ liquid oxygen transfer. Oxygen concentration may range from 10^{-7} to 10^{-6} % by mass. The LBE mass flow typically is 5.3 kg/ s.

The geometry of tested samples is cylindrical with 6 mm diameter and 35 mm length, including the screw threads for connecting samples with each other. Up to 36 samples of that size may be installed at the same time, in two vertical test sections. The resulting flow velocity along the material surface is 2 m/s for the standard sample geometry and LBE mass flow. A glove box filled with argon (Ar) houses the locks of the test sections so that samples are introduced or removed from the loop in oxygen-depleted atmosphere.

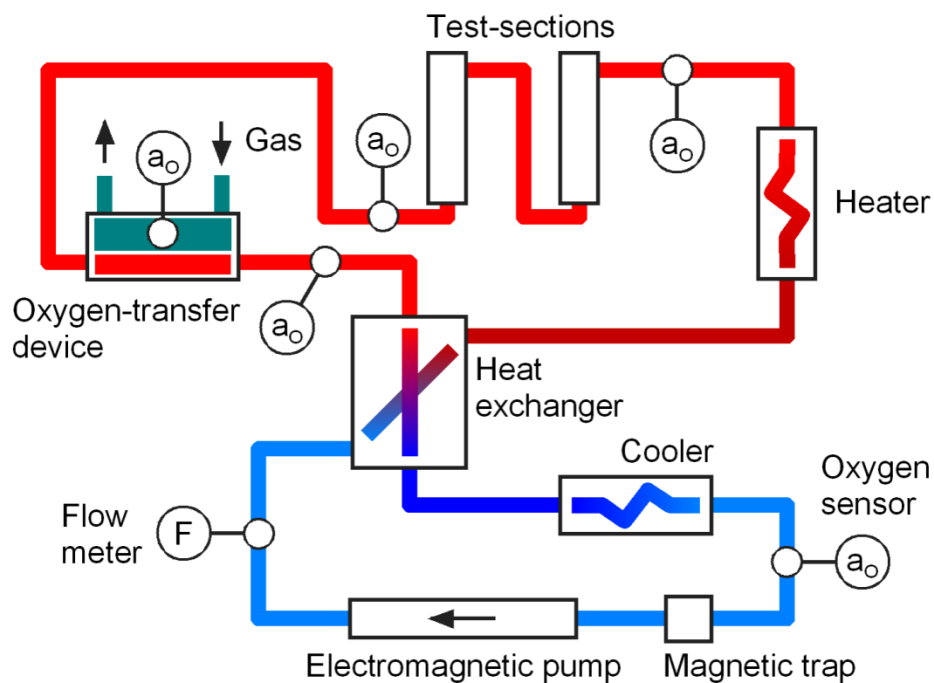
The main components of the CORRIDA loop are made of austenitic stainless steel (DIN W.-Nr 1.4571 or X6CrNiMoTi17-12-2). Electrochemical oxygen sensors measure the oxygen chemical potential in four positions along the loop, after oxygen transfer, before and after the two test sections as well as in the cold leg of the loop. During steady operation, the cover gas composition in the oxygen-transfer device of the loop is automatically varied in response to the signal of the oxygen sensor before the test sections.

The total operating time of the loop currently is 113,000 h.

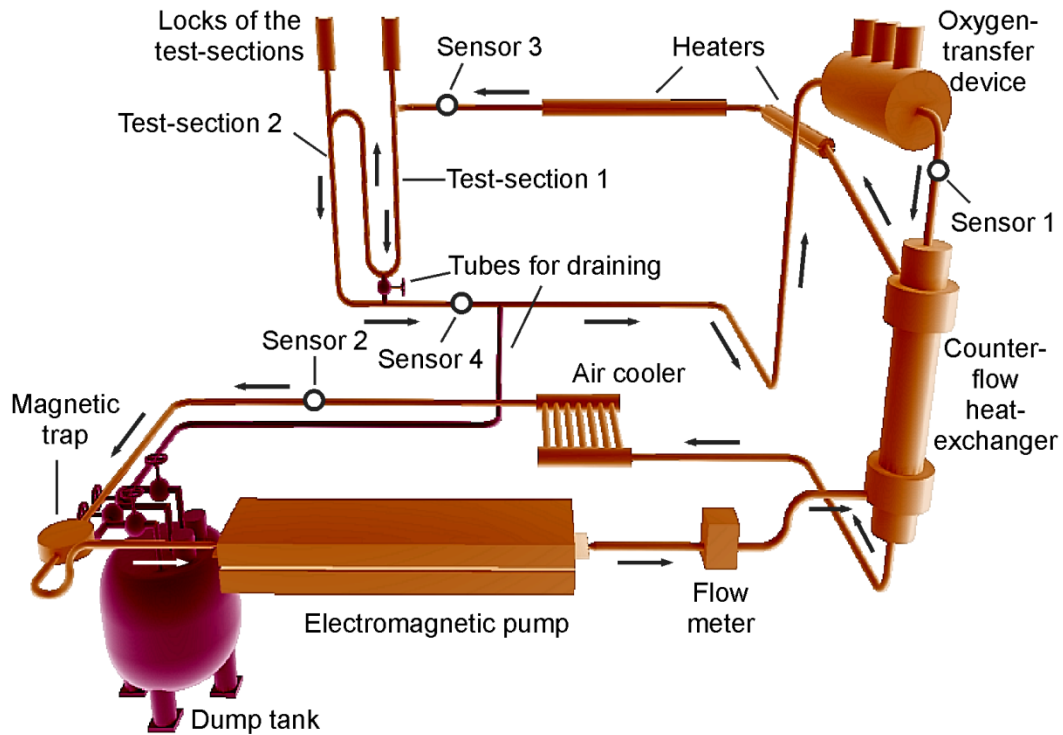
Acceptance of radioactive material

No

Scheme/diagram



3D drawing/photo



Parameters table

Medium (Coolant) inventory	Overall 2800 kg, 1000 kg circulating in the loop
Power	250 kW
Test sections	
TS #1-2	<u>Characteristic dimensions</u> Ø25 × 2.5 mm (outer diameter × wall thickness)
	<u>Static/dynamic experiment</u> Dynamic
	<u>Temperature range in the test section (Delta T)</u> 400 °C (110 °C) to 550 °C (165 °C)
	<u>Operating pressure and design pressure</u> Atmospheric
	<u>Flow range (mass, velocity, etc.)</u> Up to 5.3 kg/ s or 2 m/s for standard geometry of corrosion samples
Medium (Coolant) chemistry measurement and control (active or not, measured parameters)	Automated oxygen control system based upon gas/liquid oxygen transfer. Oxygen concentration is measured in four positions along the loop with the aid of electrochemical oxygen sensors.
Instrumentation	Flow meter, oxygen sensors with platinum (Pt)/ air reference electrode, various thermocouples

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

Exposure of various steels (ferritic/martensitic, austenitic, with and without modified surface) to flowing oxygen-containing LBE at 2 m/s and: 550 and 450°C/10⁻⁶ % (by mass) dissolved oxygen; 550, 450 and 400°C/10⁻⁷ % oxygen. Main results are oxidation kinetics, incubation and progress of solution-based corrosion. Experience from operating the CORRIDA loop was used to analyse and optimise oxygen control of flowing LBE as well as to demonstrate long-term operation of electrochemical oxygen sensors. The experiments in the CORRIDA loop contributed to European research projects such as IPEUROTRANS/DEMETRA and MATTER.

PLANNED EXPERIMENTS (including time schedule)

Corrosion tests in flowing LBE at 500 °C and 10⁻⁶ % dissolved oxygen as part of the HORIZON 2020 project GEMMA (2017-06-01 to 2021-05-31).

TRAINING ACTIVITIES

Depending on availability

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