

Profile SFR-14

CORONa

FRANCE

GENERAL INFORMATION

NAME OF THE FACILITY Corrosion in Sodium (Na)
ACRONYM CORRONa
COOLANT(S) OF THE FACILITY Sodium or other liquid metals
LOCATION (address): CEA Saclay – 91400 Gif sur Yvette, France
OPERATOR CEA (French Alternative Energies and Atomic Energy Commission)
CONTACT PERSON J-L COUROUAU (engineer-researcher), F. ROUILLARD, DEN, DPC,
(name, address, institute, function, telephone, email): SCCME, jean-louis.courouau@cea.fr, fabien.rouillard@cea.fr

STATUS OF THE FACILITY In operation
Start of operation (date): 2010

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

Corrosion tests of materials (steels, ceramics, coatings...) in liquid sodium, as well as the development of specific techniques (instrumentation, purification).

Test duration from a few hours to thousands of hours.

Investigation on mechanisms and kinetics, corrosion modeling for prediction of service life-time

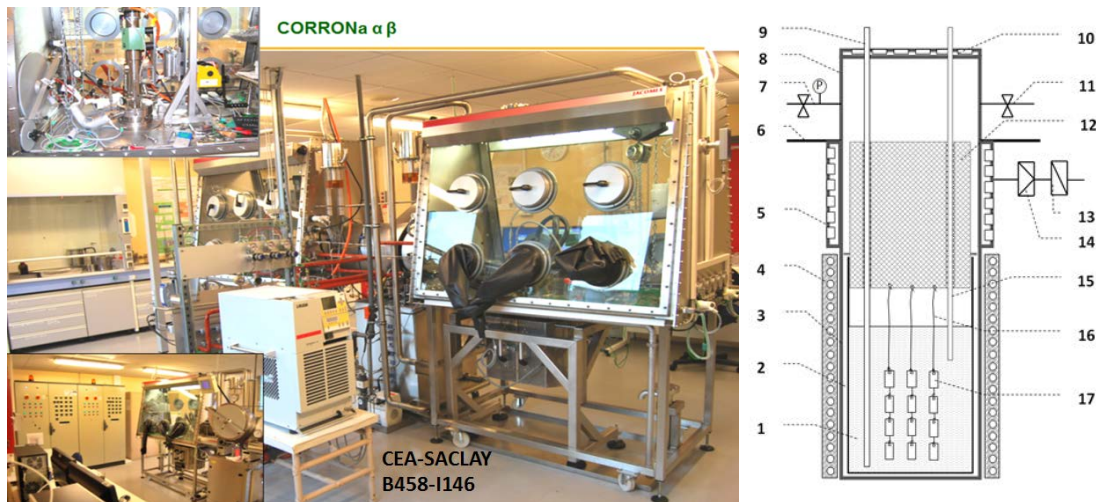
R&D devices with 6 setups for testing corrosion in static liquid sodium, with different function such as tribology, in-liquid mechanical tests, rotating cylinders....

Other liquid metals or high boiling point liquids at high temperature can be used.

Acceptance of radioactive material

No

Scheme/diagram



1- Liquid sodium, 2- Molybdenum crucible, 3- Thermal well, 4- Oven, 5-Cooling channels, 6-Gloves box floor, 7- Gas inlet and pressure monitoring, 8- Well cover, 9- Temperature well, 10- Upper cover cooling section, 11- Gas outlet, 12- Sodium vapor reflux condenser, 13- Aerosols filter, 14- Bursting disks, 15- Oxygen sensor, 16-Molybdenum wires, 17- Corrosion specimen

Parameters table

| | |
|--|--|
| Coolant inventory | 5x 2.3 kg of liquid metal (Na) + 0.1 kg of liquid metal in 6 different gloves boxes |
| Power | 5 x 6 kW + 0.25 kW |
| Test sections | |
| TS #1 | <u>Characteristic dimensions</u> Height 200mm – diameter 168 mm |
| | <u>Static/dynamic experiment</u> Stagnant configuration (pseudo stagnant – Natural convection) - Number of sample: from 1 to 40, depending on size (max 100 x 100 mm) and duration requested |
| | <u>Temperature range in the test section :</u> Maximum temperature of 700°C |
| | <u>Operating pressure and design pressure</u> Atmospheric pressure |
| | <u>Flow range (mass, velocity, etc.): mm/s to cm/s</u> |
| Coolant chemistry measurement and control (active or not, measured parameters) | <ul style="list-style-type: none"> - Chemistry controlled by operating procedures, design options and measurements (samplings) depending of the test requirements - Large possibilities of chemical conditions as the coolant is renewed for each test |
| Instrumentation | In situ meters for oxygen and carbon under development |

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

More than 100 000 hours of continuous operations since the start up in 2010 for 100th of different samples.

Some main highlights of the main results and achievements:

1. Studies of the mechanisms of corrosion in liquid sodium on 316L(N) steel for the long term modelling of the structural materials in liquid sodium, particularly on the specific role of the dissolved oxygen content and the interaction with specific ternary oxides – PhD M. Rivollier (2017)
2. Studies of the behavior of ceramic materials in liquid sodium (Alumina, Zirconia, Hafnia...) as regards the specific role of impurities segregated at grain boundaries on the compatibility and the long term corrosion mechanism involving ternary oxide formation for core catcher application or electrochemical oxygen meter
3. Studies of liquid metal embrittlement on steels – PhD Samuel Hemery 2013, postdoc Bassem Barkia (2017)
4. Long term collaboration with CNRS -LEPMI, CentraleSupélec LGPM and MSSMAT labs, and now ENSAM

PLANNED EXPERIMENTS (including time schedule)

Planning for tests is full for 2019 with many different in sodium materials testing, a mechanical test bench is planned for construction in 2019

TRAINING ACTIVITIES

No specific training activities apart from PhD and postdoc students

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