

Profile SFR-15

DIADEMO Na

FRANCE

GENERAL INFORMATION

NAME OF THE FACILITY	DIADEMO Na
ACRONYM	DIADEMO Na
COOLANT(S) OF THE FACILITY	Sodium, Nitrogen and Lead-Lithium eutectic
LOCATION (address):	CEA Cadarache 13108 Saint Paul Lez Durance FRANCE
OPERATOR	CEA
CONTACT PERSON (name, address, institute, function, telephone, email):	O. GASTALDI CEA Cadarache Building 208, 13108 Saint Paul Lez Durance, FRANCE Sodium Technology and Components Project Manager +33 4 42 25 46 40 Olivier.gastaldi@cea.fr

STATUS OF THE FACILITY	In operation
Start of operation (date):	2013

MAIN RESEARCH FIELD(S)	<input type="checkbox"/> Zero power facility for V&V and licensing purposes
	<input type="checkbox"/> Design Basis Accidents (DBA) and Design Extended Conditions (DEC)
	<input checked="" type="checkbox"/> Thermal-hydraulics
	<input type="checkbox"/> Coolant chemistry
	<input type="checkbox"/> Materials
	<input checked="" type="checkbox"/> Systems and components
	<input type="checkbox"/> Instrumentation & ISI&R

TECHNICAL DESCRIPTION

Description of the facility

The DIADEMO-Na facility has been adapted by creation of a complete liquid sodium loop in complement to existing gas and PbLi eutectic circuits initially called DIADEMO. This facility allows, among others, the test of a sodium/gas heat exchanger mock-up with 40 kWth power.

In the design of the additional sodium loop, an independent sodium pot and a test section with circulating sodium (few m.s⁻¹) have been included to enlarge this facility potentiality. Specific

instrumentation or small components prototype will be tested in this sodium pot and in the dynamic test section (flowmeters, valves...).

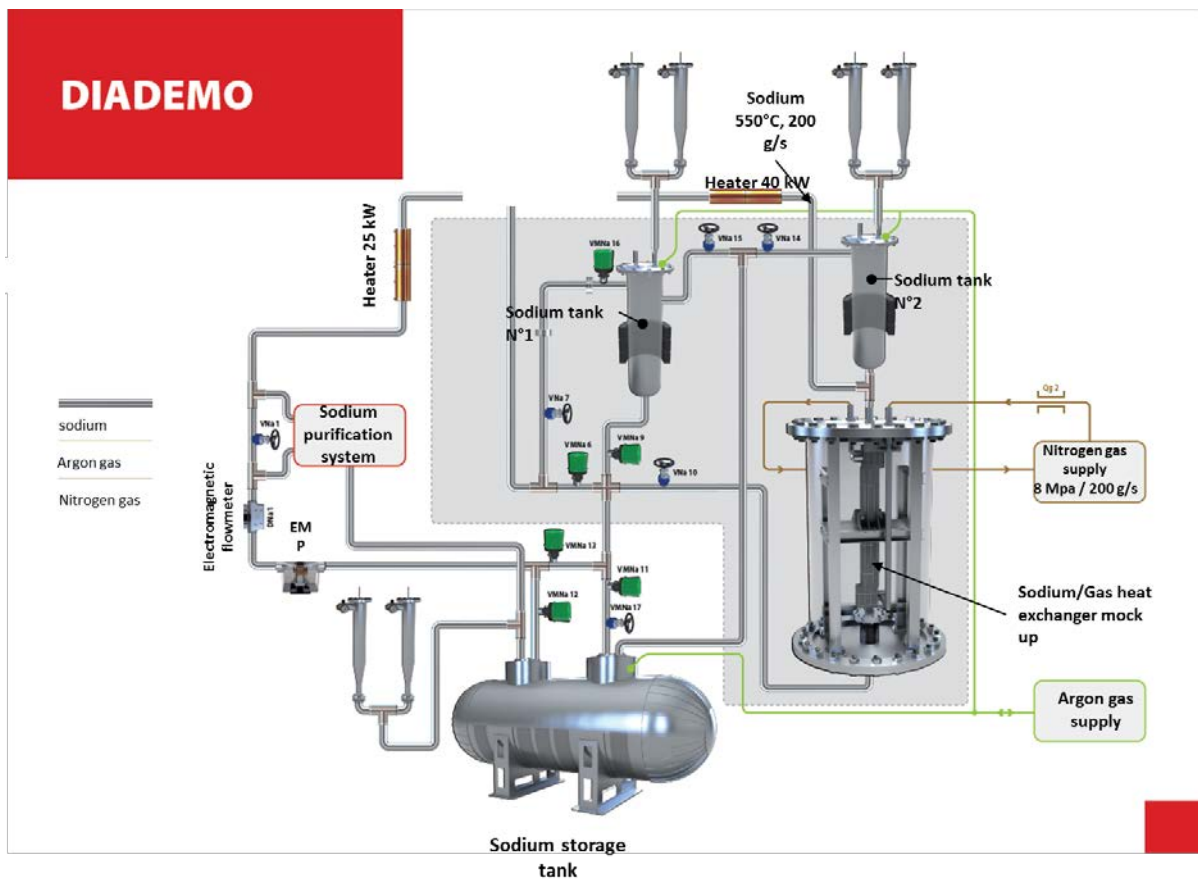
Two configurations are possible: gas exchanging heat with the Pb-Li loop or gas exchanging heat with the sodium circuit. This test platform is mainly composed of:

- a sodium circuit,
- a gas pressure circuit,
- a test section containing a plate machined heat exchanger Na / gas,
- a test instrumentation section Na,
- a Pb-Li system with its test section containing a model of heat exchanger diving in Pb-Li and wherein the gas flows,
- a cooling water circuit,
- a compressed air circuit feeding the electropneumatic valves (valves circuit sodium valves gas circuit).

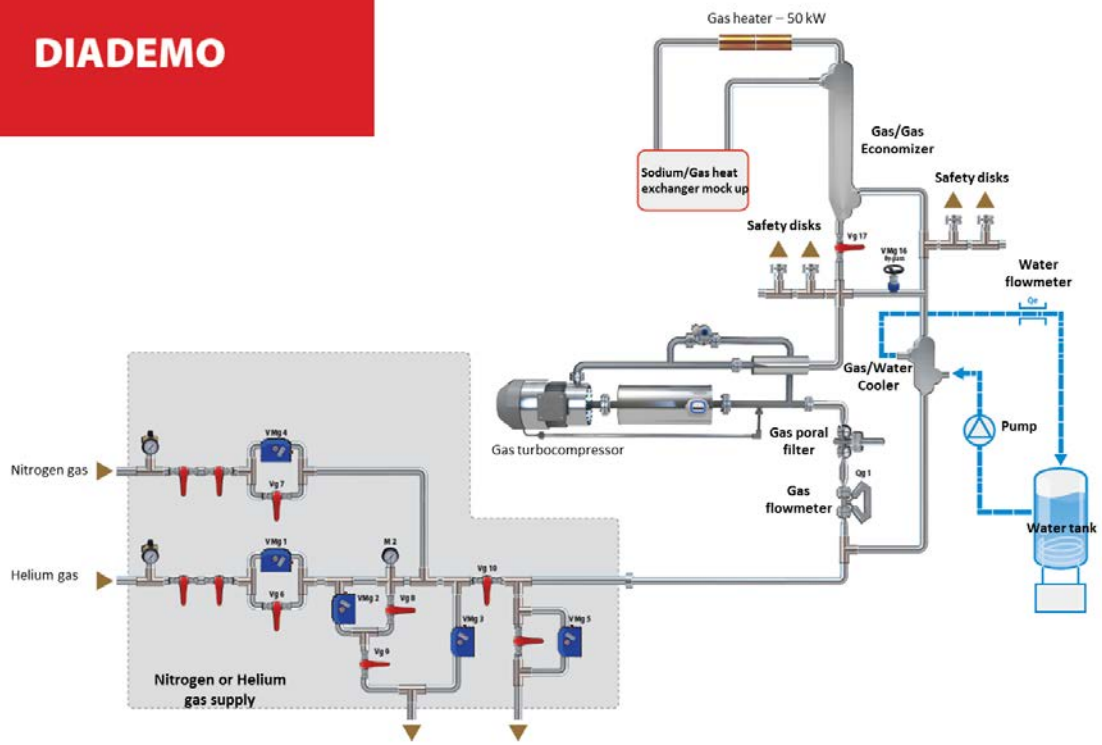
Acceptance of radioactive material

No

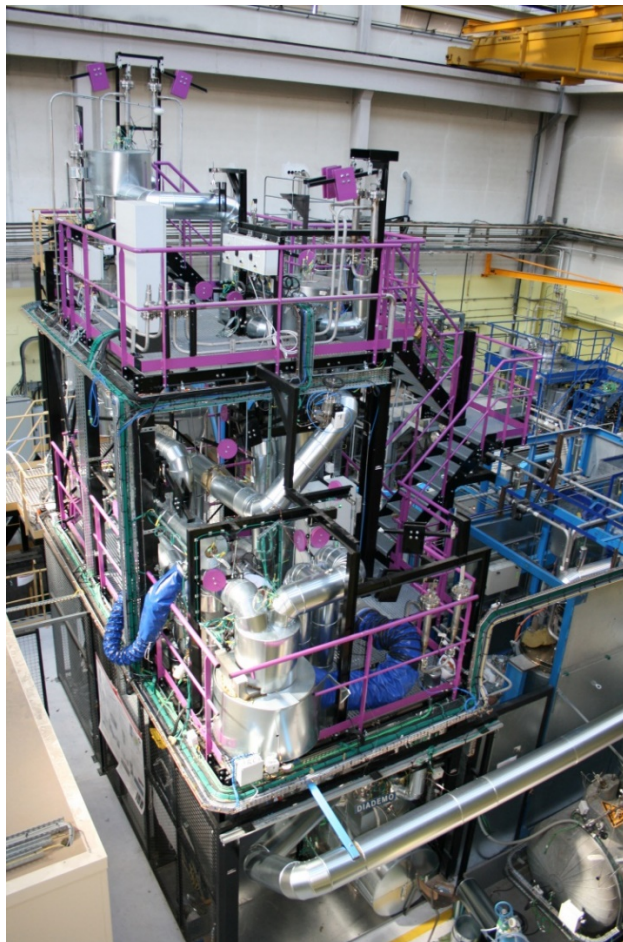
Scheme/diagram



DIADEMO



3D drawing/photo



Parameters table

Coolant inventory	300 L of Na, 55 L of PbBi
Power	40 kWth for heat exchange
Test sections	
TS #1 – Heat exchanger mock-up	<u>Characteristic dimensions</u> About 1.2 x 0.2 x 0.2 m
	<u>Static/dynamic experiment</u> Dynamic experiment in steady state and transient conditions
	<u>Temperature range in the test section (Delta T)</u> For sodium: between 340°C and 550°C
	<u>Operating pressure and design pressure</u> For nitrogen circuit, operating pressure: 80 bar and design pressure: 100 bar For sodium circuit : operating pressure < 500 mbar and design pressure: 3 bar
	<u>Flow range (mass, velocity, etc.)</u> For sodium: Flow rate: 2 m ³ /h, Velocity depends on the design of mock-up in test section For nitrogen: Mass flow rate: 200 g/s
TS #1	<u>Characteristic dimensions</u> 1.2 m x 0.025 m diam. in the current configuration
	<u>Static/dynamic experiment</u> Dynamic
	<u>Temperature range in the test section (Delta T)</u> 200 to 550°C
	<u>Operating pressure and design pressure</u> operating pressure < 500 mbar and design pressure : 3 bar
	<u>Flow range (mass, velocity, etc.)</u> Sodium flowrate: 2 m ³ /h
Coolant chemistry measurement and control (active or not, measured parameters)	Active coolant quality measurement and control (purification on a by passed flow: 1 m ³ /h and impurities level < few ppm)
Instrumentation	Thermocouples In sodium pressure measurement Inductive level probes Electromagnetic flowmeters for sodium and PbLi Gas flowmeter Gas pressure sensors

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

Test campaigns on four PMHE heat exchanger mock-up were performed between 2013 and 2018.

PLANNED EXPERIMENTS (including time schedule)

N° Mock up	Designer / provider	Manufacturing process	Fluids	Pattern	Schedule
1	CEA / CEA	DB-HIP* (type 1)	Na / N ₂	Way channel	2013
1 bis		DB-HIP* (type 1)	Na / N ₂		2014
2		DB-HIP* (Type 2)	Na / N ₂		2015-2016
2bis			Na / N ₂		2016-2018
3	CEA / CEA	DB-HIP* (Type 2)	Na / N ₂	Straight channel	2020-2021
4	CEA / CEA		Na / N ₂	To define	2022-2023
5	CEA / CEA	DB-HIP* (Type 2)	Na / H ₂ O	To define	2025-2027
6	CEA / CEA	Additive manufacturing	Na / N ₂ or Na / H ₂ O	To define	2029-2030

*DB-HIP: diffusion bonding by hot isostatic pressure

In the next years, a study is planned to add a pressurized water circuit on the DIADEMO facility to be able to qualify sodium / water heat exchanger.

TRAINING ACTIVITIES

Possible, but no specific training activities

REFERENCES (specification of availability and language)

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