Profile SFR-31

NATAN

GERMANY

GENERAL INFORMATION
NAME OF THE FACILITY: NATrium-VersuchsANlage (in German)
ACRONYM: NATAN
COOLANT(S) OF THE FACILITY: Liquid sodium
LOCATION (address): Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Institute of Fluid Dynamics, MHD Department, Dresden, Germany
OPERATOR: HZDR
CONTACT PERSON: Sven Eckert, HZDR, Bautzner Landstr. 400, 01328 Dresden, Germany, Head of Department Magnetohydrodynamics, Tel. +49 351 2602132, s.eckert@hzdr.de

STATUS OF THE FACILITY
In operation
Start of operation (date): 1988

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
The facility NATAN is a liquid sodium loop equipped with three different test sections for thermal-hydraulic experiments, tests of components and instrumentation as well as for investigations of the behaviour of different materials under the impact of flowing sodium. The facility operates with an inventory of 120 l sodium at temperatures up to a maximum of 400°C. All components to be in contact with the liquid metal are made of stainless steel. The facility consists of two storage tanks with argon cover gas, an expansion tank, an electromagnetic pump, a cold trap, a pluggingmeter, a cooler and the piping system. All pipes
and components are equipped with electrical heaters and thermal insulation. The operating status of the facility is monitored by thermocouples, pressure sensor gauges and electromagnetic flow meters. Argon gas can be injected at various positions of the facility in order to investigate the behaviour of liquid metal two-phase flows. Diverse magnetic systems are available for magnetohydrodynamic studies focusing on the effect of magnetic fields on the mean flow, the turbulence and the heat and mass transfer.

The NATAN facility provides two vertical and one horizontal test section with mainly rectangular cross sections of $45 \times 50 \text{ mm}^2$. A maximum flow velocity of about 1.5 m/s can be achieved in this cross-sectional area. Specific sensors can be installed for investigations of flow structure and transport processes.

Acceptance of radioactive material
No

Scheme/diagram

FIG. 1. Scheme of the NATAN facility
FIG. 2. View of the NATAN facility

FIG. 3. View of the electro-magnetic pump of the NATAN facility
**Parameters table**

<table>
<thead>
<tr>
<th>Coolant inventory</th>
<th>sodium inventory 120 kg</th>
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<tr>
<td>Operation temperature</td>
<td>&lt; 400°C</td>
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**Test sections**

| TS 1 | Horizontal, mixing boxes for flow homogenization, duct length: 2.5 m, cross-section: $45 \times 50 \text{ mm}^2$, max. Na velocity: 1.5 m/s, Options: magnetic system, wall heating for heat transfer studies |
| TS 2 | Vertical, height: 3 m, cross-section $45 \times 50 \text{ mm}^2$, max. Na velocity: 1.5 m/s, Options: gas injection, magnetic system |
| TS 3 | Vertical, height: 2 m, cross-section: circular with 45 mm diameter, max. Na velocity: 2 m/s, Option: gas injection |

**Instrumentation**

Thermocouples, pressure transducer, electromagnetic flow meter, Gas injection system, ultrasound Doppler velocimetry (UDV), Contactless Inductive Flow Tomography (CIFT), Inductive system for bubble detection, Local electrical probes for measurements of turbulent
COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

- Investigations of the behavior of liquid metal two-phase flows under the influence of an external DC magnetic field
- Experimental studies on the properties of MHD turbulence
- Experimental studies of the effect of DC magnetic fields on the heat transfer
- Tests of diverse materials in liquid sodium
- Tests of measuring techniques (for example: ultrasonic or inductive techniques)

PLANNED EXPERIMENTS (including time schedule)

- Tests and qualification of various measuring techniques and instrumentation

TRAINING ACTIVITIES

Training activities can be agreed with HZDR for the operation of the experimental campaign under the supervision of HZDR qualified staff.

REFERENCES (specification of availability and language)