Profile LFR-39

THESYS

GERMANY

GENERAL INFORMATION

NAME OF THE FACILITY	Technologies of heavy liquid metal systems
ACRONYM	THESYS
MEDIUM (COOLANT(S)) OF THE FACILITY	LBE
LOCATION (address):	Karlsruhe Institute of Technology (KIT) Institute for Nuclear and Energy Technologies (IKET) Hermann-von-Helmholtz-Platz 1, Bldg 415 76344 Eggenstein-Leopoldshafen Germany
OPERATOR	KIT
CONTACT PERSON (name, address, institute, function, telephone, email):	Prof. Thomas Wetzel Karlsruhe Institute of Technology (KIT) Head of Karlsruhe Liquid Metal Laboratory (KALLA) +49 721 608 23462 thomas.wetzel@kit.edu

STATUS OF THE FACILITY	Standby
Start of operation (date):	2001

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

THESYS is a LBE loop constructed for the investigation of turbulent heat transfer in an annular gap, for oxygen control experiments and for the investigation and qualification of different flow meters. It contains a test section for a heated rod, an oxygen box for the regulation of oxygen content, an air cooler, an electromagnetic induction pump and four different flow meter techniques: permanent

magnet, annubar, electromagnetic and vortex. All piping is fabricated of stainless steel (DIN 1.4849) with an inner diameter of 60mm.

The current test section contains three electrically-heated neighboring hexagonal rod bundles with wire spacers, and a fourth channel in the gap region, representing the Inter wrapper flow (IWF). It is possible to control the three thermal powers and the four flow rates independently. The selected local instrumentation is focused on capturing the heat transfer process around the IWF region, with thermo-couples at two measuring levels and at several axial positions in the gap center, as well as at the gap outlet, where a movable Pitot probe is installed. The test section geometry is representative of the core arrangement in the MYRRHA reactor.

The cooler has a maximum cooling capacity of approx. 100kW, the electromagnetic pump provides a flow rate of 14m³/h and a pressure head of 5bar which results in a maximum Reynolds number of 550.000.

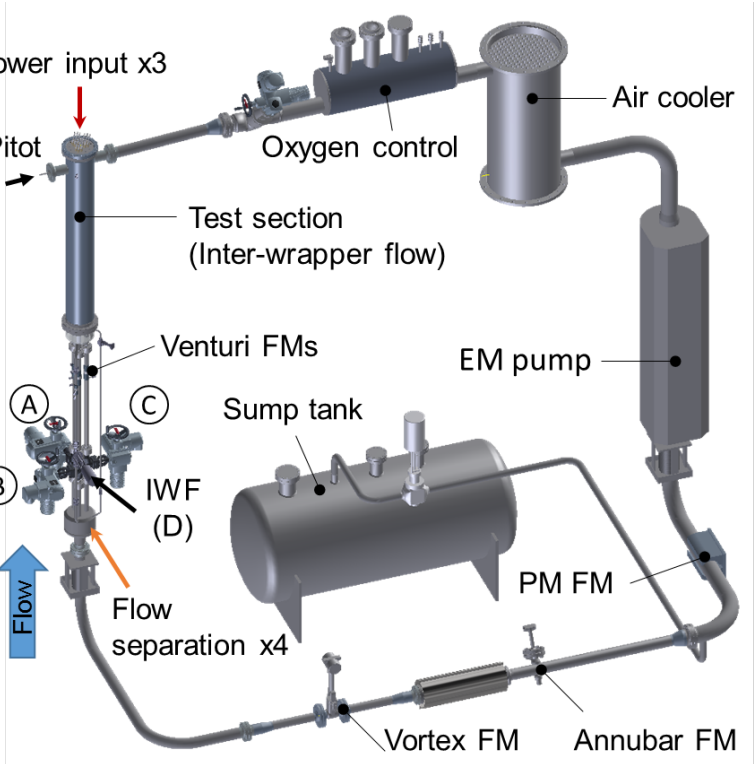
Main research interest of THESYS is:

- Thermal hydraulic investigation of a heated single rod
- Flow sensor development, qualification and calibration
- Instrumentation development

Acceptance of radioactive material

No

Scheme/diagram



3D drawing/photo

Parameters table

Medium (Coolant) inventory	220l
Power	20kW heated rod
Test sections	
TS #1	*Characteristic dimensions* height 3500mm, tube diameter 60mm
	Static/dynamic experiment dynamic
	Temperature range in the test section (Delta T) 190°C - 400°C
	Operating pressure and design pressure 5 bar
	Flow range (mass, velocity, etc.) 14 m^3/h
Medium (Coolant) chemistry measurement and control (active or not,	active oxygen control system using Pt/air sensor and gas exchange

measured parameters)	
Instrumentation	vortex flow meter EM flow meter annubar flow meter PM flow meter thermocouples pitot tube

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

LBE single rod experiment in EU-Project DEMETRA

Inter wrapper flow experiment in EU Project SESAME

PLANNED EXPERIMENTS (including time schedule)

TRAINING ACTIVITIES

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

REFERENCES (*specification of availability and language*)

J. Zeininger: Turbulenter Wärmetransport in flüssigem Blei-Wismut an einem vertikalen Heizstab im Ringspalt; 2009; http://nbn-resolving.org/urn:nbn:de:swb:90-163154

K. Litfin, A. Batta, A.G. Class, Th. Wetzel, R. Stieglitz, Investigation on heavy liquid metal cooling of ADS fuel pin assemblies, Journal of Nuclear Materials, Volume 415, Issue 3, 31 August 2011, Pages 425-432, ISSN 0022-3115, http://dx.doi.org/10.1016/j.jnucmat.2011.04.048

Pacio, J.; Daubner, M.; Fellmoser, F. & Wetzel, T., Experimental study of the influence of inter-wrapper flow on liquid-metal cooled fuel assemblies, SESAME International Workshop, Petten, The Netherlands, 19-21 March 2019, paper 033