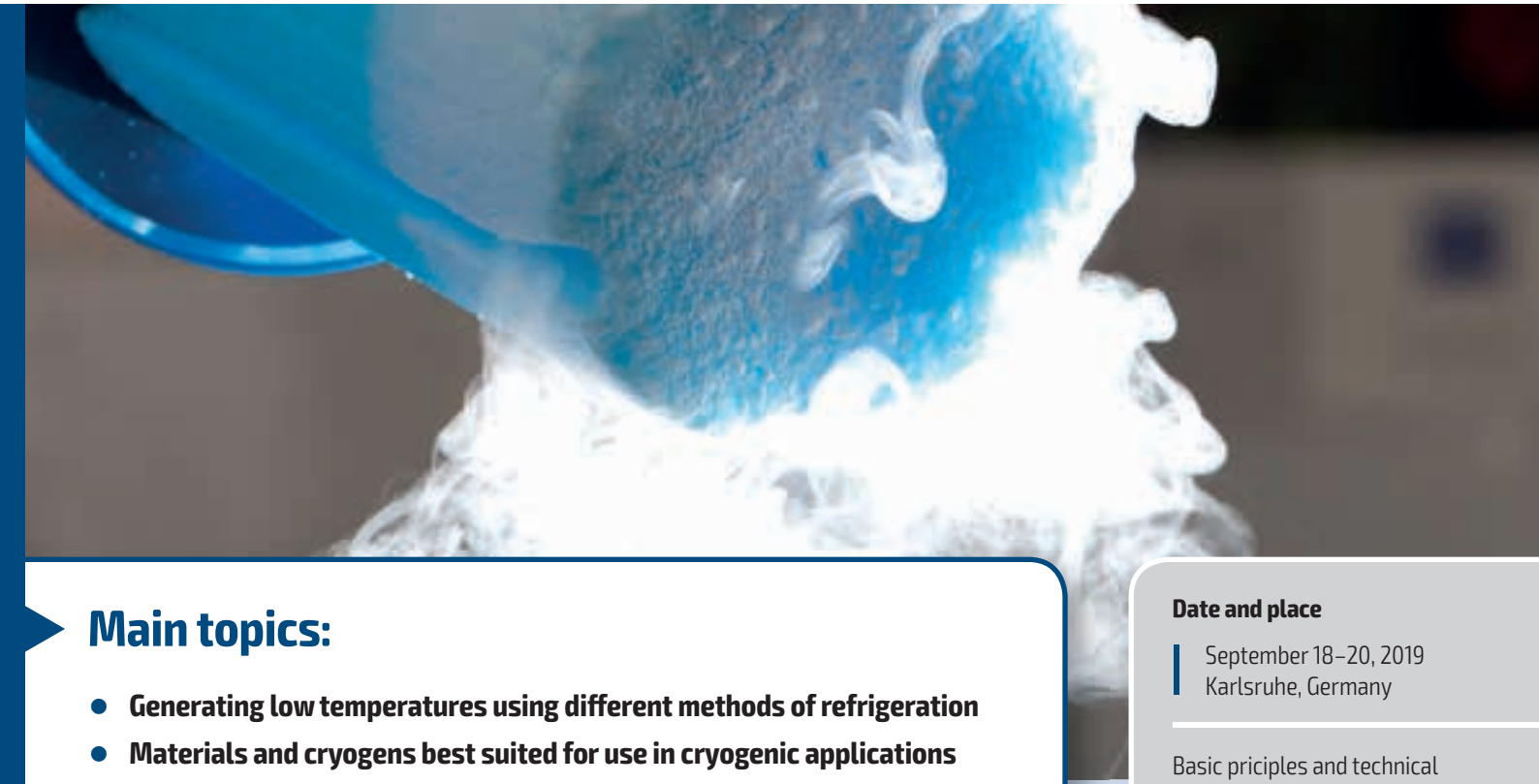
VDI Wissensforum

Forum

Cryogenics

Basic priciples, technical applications and trends



Main topics:

- **Generating low temperatures using different methods of refrigeration**
- **Materials and cryogens best suited for use in cryogenic applications**
- **Choosing the most appropriate type of insulation depending on the temperature level and generated heat**
- **Important aspects to consider during construction and specification of cryogenic systems**
- **Sensing low temperatures and choosing suitable control circuits that have proven their worth in cryogenics**
- **Dangers that can arise when dealing with cryogens**

Date and place

September 18–20, 2019
Karlsruhe, Germany

Basic priciples and technical applications – stage of development and trends

Forum chairman
Dr. Holger Neumann, Karlsruhe Institute of Technology (KIT)

An event organised by VDI Wissensforum GmbH
www.vdi-wissensforum.de/05FO006
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General information

Forum

This cryogenics information and advanced education forum was developed from an annual course in German language that is held since 48 years. During this time, cryogenics has increased in importance and is increasingly used in many spheres.

This forum imparts a technical introduction:
- Thermodynamic basics of refrigeration
- Industrial techniques of refrigeration (liquefaction, refrigeration units, cryocoolers)
- Thermodynamic properties of cryogens
- Aspects and techniques of cryogen logistics
- Basics and techniques for heat transfer to cryogens and for thermal insulation
- Design techniques and process engineering for the layout of cryogenic-systems and basics and techniques of cryogenic temperature measurement and control circuits
- Safety aspects and safety provisions for handling cryogens

The following topics concern today's and future large-scale applications in cryogenics:
- Helium refrigerators and liquefiers
- Superconducting high field magnets
- Cryopumps
- Hydrogen as an alternative fuel

Target group

- Natural scientists, engineers and technicians who work with cryogenic facilities
- Engineers and technicians working for research, development and production who want to be informed about the latest technological developments in this expanding specialist area

Forum chairman

Dr. Holger Neumann, Institute for Technical Physics, Karlsruhe Institute of Technology (KIT)

Dr. Holger Neumann obtained his degree as a civil engineer followed by a doctorate from the Ruhr-University Bochum (RUB). He is currently the Divisional Head of Cryogenics at the Institute for Technical Physics at the Karlsruhe Institute of Technology (KIT). In addition he has a standing position as University Lecturer for Thermodynamics at the Duale Hochschule Baden-Württemberg in Karlsruhe.

Forum content

1st day 9:00 a.m. – 6:15 p.m.

1. Chair's welcome and introduction
Dr. Holger Neumann, Institute for Technical Physics, KIT – Karlsruhe Institute of Technology

2. Thermodynamic basics of refrigeration
- Laws of thermodynamics for cryogenics
- Basic cryogenic cycles (Joule-Thomson-, Brayton- and Claude-processes)
- Samples refrigerators/liquefiers

Dr. Alexander Alekseev, Group R&D, Linde AG, Pullach

3. Industrial cryogen facilities
- Requirements
- Components
- Design concepts
- Application examples for different operating temperatures

Lars Blum, Linde Kryotechnik AG, CH-Pfungen

4. Refrigerants for cryogenics
- Properties of LN_2, LHe and LH_2
- Supply and handling of refrigerants
- LHe Dewar – side connection and pressure built up system
- Information about the current global Helium supply situation
- Examples of LN_2, LHe and LH_2 applications

Siegfried Ebner, Supply Chain Management, Linde AG Division Linde Gas, Unterschleißheim

5. Material properties at low temperatures
- Change of solid matter (or material) properties
  - » Heat capacity
  - » Heat conductivity
  - » Thermal contraction
  - » Embrittlement
  - » Electrical conductance
- Fluid properties
- State equations
- Property data programs for refrigerants
- Superfluid helium

Prof. Christoph Haberstroh, Bitzer Chair of Refrigeration, Cryogenics and Compressor Technology, TU Dresden

6. Heat transfer to cryogens – cooling techniques
- Heat transfer mechanisms
- Heat transfer with and without phase transition
- Heat transfer to He I and He II
- Bath cooling and forced flow cooling

Dr. Holger Neumann

2nd day 9:00 a.m. – 6:00 p.m.

7. Thermal insulation
- Basics
- Insulation techniques
- Porous insulating materials
- Vacuum
- Vacuum powder-, multi-layer insulation

Dr. Holger Neumann

8. Specification, Design and Components of Cryogenic Infrastructure
- Specifications and Requirements
- Isometrics
- Components
- Conditioning Equipment for Liquid Gas
- Examples of Applications

Ronald Dekker, Director, Demaco Holland bv, NL-Noord Scharwoude

9. Low temperature measurement and control techniques
- Temperature measurement
- Sensor choice and sensor installation
- Measurement errors
- Measurements of pressure, mass flow, displacement and level
- Valves for cryogenics
- Control loops with application examples

Dr. Holger Neumann

10. Safety in Cryogenics
- Properties of cryogens and materials at low temperature
- Risks in handling of cryogens
- Oxygen Deficiency Hazard (ODH)
- Safety-relevant construction and operation advice
- Directives and regulations

Dr. Holger Neumann

11. Cryocoolers for low temperature electronics and sensors
- Requirements
- Thermodynamic basics
- Types of cryocoolers
- Development trends

Dr. Ingo Rühlich, Head of Division Cryocoolers, AIM INFRAROT-MODULE GmbH, Heilbronn

From 7 p.m., the VDI Wissensforum invites you to refreshments with the opportunity for exchanging ideas with other participants and discussion with the speakers.

3rd day 9:00 a.m. – 4:00 p.m.

12. Superconductive high field magnets
- Generation of static magnetic fields
- Comparison of resistive and superconductive systems
- Challenges for the design and the operation of high field magnets (B > 20 T)
- Requirements for superconductive magnets for highresolution NMR-spectroscopy

Pauline Leys, Institute for Technical Physics, KIT – Karlsruhe Institute of Technology

13. Cryogenic hydrogen technology
- Hydrogen as potential future energy carrier
- Available storage technologies, current development trends
- Required cryogenic components
- Achievable operating parameters
- Hydrogen powered automobiles
- Current trends

Prof. Christoph Haberstroh

14. Cryogenic vacuum technology and cryopumps
- Vacuum basics
- Engineering procedures for cryopumps
- Commercial cryopumps
- Design of cryopumps for special applications
- Examples of tailor-made cryopumps

Dr. Thomas Giegerich, Institute for Technical Physics, KIT – Karlsruhe Institute of Technology

2:00 – 4:00 pm

++ special event – identity card required

Visit of the cryogenic department of the Institute for Technical Physics, KIT – Karlsruhe Institute of Technology

Dr. Holger Neumann

Reasons to attend

1. **You get a better understanding of the different machines, components and facilities used in cryogenics, as well as their mode of operation and special features.**
2. **You will obtain an overview about cryogenics regarding refrigerants, insulation, design, safety technology and control circuits.**
3. **You will become acquainted with different fields of application of cryogenics, e. g. vacuum technology, NMR-spectroscopy and liquid hydrogen technology.**

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Forum:
Cryogenics

+ Visit of the cryogenics department of the KIT

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You need help?
Please contact us!

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✓ **Please register for (Price per Person plus VAT):**

Forum
☐ **September 18–20, 2019** **Karlsruhe, Germany** (05F0006008)
EUR 1.690,–

www

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www.vdi-wissensforum.de/de/agb/

Venue/Accommodation:
We've blocked a number of rooms at the hotel that will also be the venue for the forum. Please mention "Event of the VDI" with your booking in order to make use of this offer.
Karlsruhe: ACHAT Plaza Karlsruhe Mendelssohnplatz, 76131 Karlsruhe, Phone: +49 721 3717-0,
Email: karlsruhe-plaza@achat-hotels.com

More Hotels close to the event venue may be found via our HRS service
www.vdi-wissensforum.de/hrs

HRS Das Hotelportal

Services: The price includes lunch as well as beverages during the breaks. The forum handbook will be distributed to the attendees on site.
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