



EUROCHAMP-2

Integration of **EURO**pean Simulation **CHAMBERS** for Investigating Atmospheric **PROCESSES**

A Research Project
within the
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List of all chambers/installations in Eurochamp

If you have questions about the **chambers** and the [transnational access](#), please contact the [coordinator](#).

During [Eurochamp-1](#) a [detailed list of all environmental and chambers within Eurochamp](#) was generated. The list has been updated and the current version includes all chambers of all partners. Not all chambers provide Transnational Access (TA) within Eurochamp-2. However, the majority of the chambers, including all larger installations, provide TA. The following table serves as a reference for the chambers and prospective users.

Name (links to description)	Partner (links to partner page)	Pictures (links to web page of the chamber)
QUAREC	BUW	
SAPHIR	FZJ	
EUPHORE	CEAM	
LOTASC	UBT	
CRAC1	UCC	
ICARE-SC	ICARE	
PSI-SC	PSI	

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Chambers QUAREC

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QUAREC: description and transnational access

1. Introduction

The Physical Chemistry Department of the University of Wuppertal has several indoor chambers of various volumes for the investigation of the photooxidation of volatile organic compounds (VOCs) at ppb and ppm concentration levels. The kinetic and product data produced by investigations in the reactors can be used to elucidate atmospheric oxidation mechanism and access the fate of chemicals in the atmosphere. **QUAREC** is the largest and most versatile of the reactors and is part of the **Transnational Access of Eurochamp-2**.

2. Description of the research facility

The physical chemistry department of the Bergische University of Wuppertal was headed by Prof. K. H. Becker up to 2001 and is now under the supervision of Prof. Th. Benter. The department has over 30 years specialist experience in the investigation of atmospheric gas phase photo-oxidation processes. Recently the activities of the department have been considerably extended to include the investigation of atmospherically relevant heterogeneous reactions, aerosols, modeling and field measurements. The appointment of Prof. Benter as department head has also added specialist knowledge on atmospheric pressure mass spectrometric analysis techniques to the group. Apart from national atmospheric science projects the senior members of the department have been involved in and also co-ordinated many European framework projects on atmospheric science. The organization was heavily involved in the building of the EUPHORE photoreactor in Valencia, Spain and presently, with other chamber-owning groups, provides advice on the running of the facility. The department has co-ordinated the German tropospheric ozone research program TFS-LT3 and was instrumental in the organization of the BERLIOZ field campaign in Berlin in the summer of 1999.

2.1. Technical data

The QUAREC reactor consists of two quartz glass cylinders connected by a central enamel flange ring and silicon rubber seals and is closed at both ends by aluminum flanges. It has a total length of 6.2 m and an inner diameter of 0.47 m. A schematic representation of the reaction chamber experimental setup is shown in section 2.2 Images. The reactor can be evacuated by a turbo molecular pump (Leybold-Heraeus PT 450) backed by a Leybold D65B double stage rotary vacuum pump to a pressure of less than 10^{-3} mbar. To ensure homogeneous mixing of the reactants three fans with Teflon blades are mounted inside the chamber. Both end flanges contain inlet systems for reactants and bath gases and ports for mounting pressure and temperature measurement instruments. A gas flow controller can be used for the compensation of total pressure within the reactor when using analytical instrumentation that requires high volume gas samples.

The chamber is equipped with 32 super actinic fluorescent lamps (Philips TL 05/40 W: $320 < \lambda < 480$ nm, $\lambda_{\max} = 360$ nm) and 32 low-pressure mercury lamps (Philips TUV40W, $\lambda_{\max} = 254$ nm) which are spaced evenly around the reaction vessel. The lamps are wired in parallel and can be switched individually, which allows a variation of the light intensity, and thus also the photolysis frequency/radical production rate, within the chamber. A White type multi- reflection mirror system with a base length of (5.91 ± 0.01) m for sensitive in situ long path absorption monitoring of both reactants and products in the IR spectral range is mounted on the flanges. The White system is operated at 82 traverses, giving a total optical path length of (484.7 ± 0.8) m. IR spectra are generally recorded with a spectral resolution of 1 cm^{-1} using a NICOLET NEXUS FTIR spectrometer equipped with a liquid nitrogen cooled (77 K) mercury-cadmium- telluride (MCT) detector.

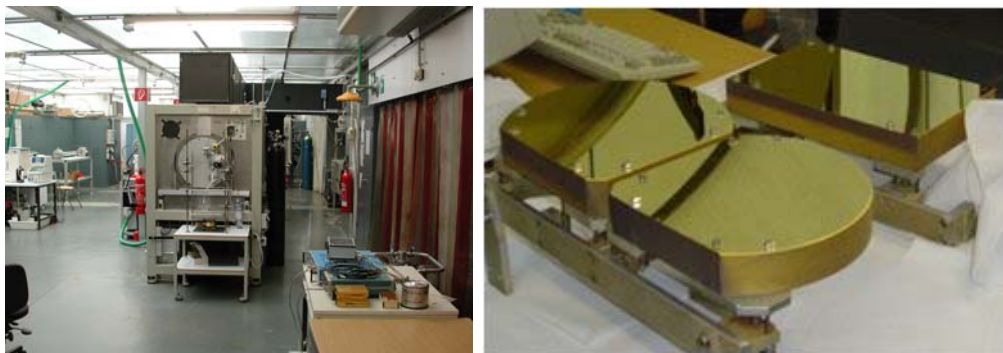
The reactor can be temperature regulated within the range 283-313 K with a precision of ± 1 K.

Aerosol measurements can be made in the reactor using a scanning mobility particle sizer (SMPS) system. The Model 3934 SMPS system consists of an electrostatic classifier and two independent condensation particle counters (CPC) (TSI 3022 A connected to the classifier and a stand-alone TSI 3025 ultra-fine condensation particle counter UCPC).

Outlet ports are located on the end flanges to which monitoring instrumentation can be attached. An outlet port for particle sampling is located on the central flange of the reactor.

2.2. Images





2.3. Publications

The following publications serve to demonstrate the types of investigations which can be performed in the reactor:

Temperature dependence of the gas-phase reactions of Cl atom with propene and 1-butene between $285 < T < 313$ K
Ceacero-Vega, B. Ballesteros, J. Albaladejo, I. Bejan, I. Barnes *Chemical Physics Letters* 484 (2009) 10-13.

FTIR relative kinetic study of the reactions of $(\text{CH}_3\text{CH}_2)_2\text{S}$ and $\text{CH}_3\text{CH}_2\text{SCH}_3$ with OH radicals and Cl atoms at atmospheric pressure
G. Oksdath-Mansilla, A. B. Peñeñory, M. Albu, I. Barnes, P. Wiesen, M. A. Teruel *Chemical Physics Letters* 477 (2009) 22-27 (doi:10.1016/j.cplett.2009.06.035).

OH-Initiated degradation of unsaturated esters in the atmosphere: Kinetics in the temperature Range of 287-313 K
M. B. Blanco, I. Bejan, I. Barnes, P. Wiesen, M. A. Teruel *Journal of Physical Chemistry A* 113 (2009) 5958-5965 (DOI: 10.1021/jp901755x).

Primary product distribution from the Cl-atom initiated atmospheric degradation of furan: Environmental implications
Villanuev, F., Barnes, I., Monedero, E., Salgado, S., Gomez, M. V. and Martin, P. *Atmospheric Environment* 41 (2007) 8796-8810.

Investigations on the gas-phase photolysis and OH Radical kinetics of methyl-2-nitrophenols
I Bejan, I Barnes, R Olariu, S Zhou, P Wiesen, Th Benter *Physical Chemistry Chemical Physics* 9 (2007) 5686-5692 (DOI: 10.1039/b709464g).

Reactions of NO_3 radicals with limonene and α -pinene: product and SOA formation
M. Spittler, I. Barnes, I. Bejan, K. J. Brockmann, K. Wirtz *Atmospheric Environment* 40 Supplement 1, (2006) 116-127.

2.4. Access to the chamber under Eurochamp TA

Access to QUAREC is provided through Eurochamp-2 Transnational Access (TA) as outlined on the Eurochamp web site <http://www.eurochamp.org/>. The reactor can generally be made available for use at quite short notice. User own instrumentation can be attached to the reactor if found experimentally viable after consultation with the research facility responsible persons.

3. Institution in charge of the laboratory facility

BUW is partner 1 in Eurochamp-2.

3.1. Contact Information

Prof. Dr. Peter Wiesen, phone: +49 202 439 2515

Dr. Ian Barnes, phone: +49 202 439 2510

University of Wuppertal
FB C - Department of Physical Chemistry
Gauss Strasse 20
D- 42119 Wuppertal, Germany

4. Additional Information

n.a.



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Chambers SAPHIR

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SAPHIR: description and transnational access

1. Introduction

The large atmospheric simulation chamber SAPHIR (Simulation of Atmospheric PHotochemistry In a large Reaction Chamber) in Jülich is a tool for the quantitative experimental investigation of tropospheric chemistry under natural conditions and for the evaluation of photochemical models. The ultimate goal is the experimental verification of the chemistry of tropospheric trace compounds. [SAPHIR](#) is part of the [Transnational Access of Eurochamp-2](#).

2. Description of the research facility

SAPHIR provides a platform for quantitative, experimental verification and improvement of photochemical models at realistic concentrations and solar radiation. The results from the simulation experiment will be incorporated in models for atmospheric research which help to predict human influence on the atmosphere. Moreover, a direct comparison of field and simulation experiments is possible. SAPHIR provides an international platform for basic research and measurement intercomparisons. The following questions are addressed:

- What are the precursors and physical parameters determining the concentration radicals?
- How do parameters influence the degradation of important trace substances?
- What drives the formation and degradation of photooxidants?
- Which factors influence the formation and properties of particles?
- Which parameters affect the quality and reliability of atmospheric measurements?

The specific characteristics of SAPHIR are:

- Simulation of tropospheric photo chemistry under natural conditions.
- Multiple equipment for trace gas and aerosol measurements.
- Direct measurements of radicals, i.e. OH, HO₂, RO₂, and NO₃.
- Access for field instruments / containers.
- Versatile platform for intercomparisons of instruments.

In the atmosphere simulation chamber it is possible to simulate the photochemistry of the troposphere under natural conditions. Interferences such as transport processes or unquantifiable sources and sinks of individual trace gases can be avoided. Since the chamber can be flooded with air of a selectable composition, the scientists have a set of advantages over measurements in the outside air. E.g. Nonlinear correlations can be systematically investigated over the large, naturally occurring concentration range of trace gases. In addition the impact of future trace and pollutant gases or of emission reduction strategies on the chemistry of the troposphere can be studied.

2.1. Technical data

A double-walled Teflon foil forms the boundary of the tubular chamber with a capacity of roughly 270m³. This material is permeable to the sun's UV radiation which supplies the energy required for all the chemical reactions taking place in the chamber. Teflon is chemically inert, which means that it does not react with trace gases. The interspace of the double wall is constantly purged with ultraclean gases so that the adjusted chamber atmosphere does not inadvertently mix with the outside air.

The sun serves as a natural light source. A louvre system permits chemical reactions of the air to be also analysed in the dark or under different light conditions. The photolysis rates inside the chamber can be precisely calculated from outside radiometer measurements.

shape	cylinder
size	diameter: 5 m / length: 18 m
volume / inner surface	270 m ³ / 320m ²
lighting	natural sun light
shading:	roof, louvre system, several stages
roof closing time:	50 s
gas purity:	N ₂ /O ₂ 6.0
maximum purge rate:	400 m ³ /h (1/e-time 40 min)
wall material:	FEP-Teflon (150 µm), double-walled
temperature range:	ambient temperature
operating pressure:	50 Pa above ambient

2.2. Images



2.3. Publications

A detailed list of publications is provided [here](#).

2.4. Access to the chamber under Eurochamp TA

Access to SAPHIR is provided through Eurochamp-2 Transnational Access and other collaborations. Please contact us find the appropriate setup for new projects at SAPHIR.

SAPHIR offers access to various types of instruments. These instruments can be placed next to the chamber floor inside of containers (e.g. see the experimental sections of [Schlosser et al. 2009](#) and [Apel et al. 2008](#) for details). Modifications of inlet lines or flanges can be provided on request. Access to workshops and laboratories can be provided after consultation. Status data of the chamber and the data of the installed instruments are available for the user.

3. Institution in charge of the laboratory facility

The Institute for Chemistry and Dynamics of the Geosphere (ICG) at Forschungszentrum Jülich (FZJ) is integrated in the "programmorientierte Förderung (PoF)" (Programme Oriented Funding) of the "Helmholtz-Gemeinschaft Deutscher Forschungszentren" (HGF). Together with the Research Centre Karlsruhe (FZK) and the German National Research Centre for Geosciences (GFZ) the ICG-1 (Stratosphere) and ICG-2 (Troposphere) form the main focus in the programme "Atmosphere and Climate" in the research field "Earth and Environment".

[FZJ](#) is [partner 2](#) in Eurochamp-2.

3.1. Contact Information

[Prof. Andreas Wahner](#), phone: +49 24 61 61 46 92

[Dr. Theo Brauers](#), phone: +49 24 61 61 66 46

Forschungszentrum Jülich
Institut für Chemie und Dynamik der Geosphäre
Institut 2: Troposphere
D-52425 Jülich, Germany

4. Additional Information

n.a.



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Chambers EUPHORE

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EUPHORE: description and transnational access

1. Introduction

The European PHOtoREactor was designed by a consortium of 7 research institutes from 4 countries within the EU. The EUPHORE simulation chambers are operated by the Mediterranean Center for Environmental Studies Foundation (CEAM). The Foundation was created in 1991 by the Generalitat Valenciana and Bancaja, with the support of the Secretariat of State for Universities and Research and the European Commission (DG Research). **EUPHORE** is part of the **Transnational Access of Euochamp-2**.

2. Description of the research facility

The main objectives of the Atmospheric Chemistry area, within the Atmospheric pollution area, are: i) Investigation into the photochemical degradation of atmospheric pollutants and study of generated products which present a potential risk for health and environment. ii) Database development with international projection, iii) Validation and implementation of photochemical models. iv) Development and validation of new instrumentation, as well as improvement of the already existing one v) Exploitation of the EUPHORE smog chambers, for the development of research projects managed by the Foundation, as well as for other national and international institutions.

2.1. Technical data

The Installation has two twin outdoor atmospheric simulation chambers. Each one consists of a half spherical Teflon bag with a volume of about 200m³. The chambers are made from a fluorine-ethene-propene (FPE) foil with a thickness of 0.13 mm whereby 32 individual segments are welded together to achieve the half-spherical form. This foil has a transmission of more than 80% for sunlight in the near UV and the visible range between 280 nm and 640 nm, which is the important range supplying the energy for the chemical reactions occurring in photo-oxidation processes in the troposphere. Teflon is a chemically inert material and provides the best choice to avoid uncontrolled reactions of the trace gases with the chamber walls.

The chamber is self-stabilising against wind distortions when operated with an excess pressure of 100-200 Pa. An internal framework made of epoxide resin tubes based on a half-spherical network construction keeps the foil in shape in the absence of excess internal pressure. The chamber floor consists of 32 symmetrically arranged aluminium panels covered with FPE foil, and an integrated rubber cord is used as a seal between the bag and the floor. One of the technical innovations is the refrigeration system integrated in the chamber floor, which compensates heating of the chamber air by solar radiation. Ports for input of the reactants and sampling lines for the different analytical instruments are located on the chamber floor.

Analytical instrumentation: The simulation chambers are equipped with a broad number of analytical instruments in order to analyse VOCs, O₃, NO, NO₂, PAN, organic nitrates, hydroperoxides and organic acids. For in-situ measurements highly sensitive and selective techniques such as LP-FTIR and LP-UV/VIS DOAS spectroscopy are available. For the sensitive analysis of reaction products several ozone and NOx monitors, as well as HCHO monitor, HONO-LOPAP monitor, GC-MS and GC-MS/MS systems can be employed for sampling the trace gas components directly from the gas phase, with pre-concentration techniques or solvent trapping. For the measurement of OH and OH₂ radicals a Laser Induced Fluorescence LIF is available with its excellent potential for obtaining insight into radical formation and radical cycling processes, responsible for ozone and photo-oxidant formation. To measure aerosol formation from biogenic or anthropogenic precursor VOCs during oxidation, the EUPHORE installation is equipped with a SMPS system and a continuous-operating microbalance (TEOM) providing particle numbers and mass concentration. Other off-line techniques, such as HPLC and LC-MS or GC-MS for the analysis of different range of compounds, both in gas and particle phase, are also available.

2.2. Images



2.3. Publications

A detailed list of publications is provided [here](#).

2.4. Access to the chamber under Eurochamp TA

Typically, users perform their experiments in a collaborative effort together with CEAM researchers and technicians. Some of the instruments could be handle by the external visitors, meanwhile others will be operated by CEAM staff as agreed in the negotiation of each proposal, as well as related data analysis by CEAM staff. A typical length of a use will be about 2 or 3 weeks.

The unit of access is defined as one day spent by any group at each of the Euphore chambers. The full time period is counted from the day of arrival until the day of departure; the eligible period thus includes also the preparatory phase to set up instruments at the begining. After each campaign, the chamber requires two days of cleaning. All these cleaning days are counted too, as the chamber cannot be used for other purposes during this cleaning procedure.

3. Institution in charge of the laboratory facility

The CEAM Foundation is a Center of Applied Research and Technological Innovation, and it also operates as an associated unit of CSIC. The CEAM is conceived as a mutlidisciplinary center, focussing its performances on complementary thematic areas in which it provides internationally recognized expertise. The scientific activity of the Foundation is articulated in four research programmes: Atmospheric Pollution, Air Pollutant Effect, Forest Research and Meteorology-Climatology.

[CEAM](#) is [partner 3](#) in Eurochamp-2.

3.1. Contact Information

[Dr. Amalia Muñoz](#)

4. Additional Information

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Chambers LOTASC

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LOTASC: description and transnational access

1. Introduction

An aerosol simulation chamber has been removed from the Fraunhofer-Institute at Hannover and been reinstalled at the University of Bayreuth in the new refrigerator laboratory, coolable to -25°C to constitute a new facility the low-temperature aerosol simulation chamber (LOTASC). It mainly investigates the aerosol-partitioning of semi-volatile compounds and heterogeneous chemistry of adsorbents, as well as gas phase hydrocarbon reactivity at low temperature (down to -25°C). This will allow us to simulate tropospheric photochemistry, including cirrus clouds. [LOTASC](#) is part of the [Transnational Access of Eurochamp-2](#).

2. Description of the research facility

Actually there are three smog chambers in the Atmospheric Chemistry Research Laboratory. One is the big glass chamber known as LOTASC; the second is a Teflon chamber which is located in the same refrigerator room with LOTASC and could achieve low temperature; the last chamber is a medium glass smog chamber connected with IR spectrum, and it could deliver aerosol experiment at room temperature. A variety of state-of-the-art analytical instrumentation including GC/FID/ECD, GC-MS, Ion Chromatography, HPLC-DAD-Fluorescent, and UV/VIS-Spectrometer is also available. For field measurement HONO Analyzer, NO₂ and PAN Analyzer is available.

New instruments: A quadrupole MS (Pfeiffer Prisma Plus) has just arrived and is being tested with a temperature-programmed desorption/pyrolysis up to 1000°C . A Helium Ionization Detector, HID (VICI Model D-4-I) is being connected with a GC to determine aldehydes and other compounds with low FID response.

2.1. Technical data

The smog chamber is made of glass (Duran, Schott). The cooling of the chamber should decrease the evaporation of substance from the surface of the particles, and the experiments could be made at environmentally relevant temperature of the troposphere, for example at the middle, global tropospheric temperature or simulate even the Arctic climate. The size of the smog chamber limits the residence time of the agglomerates. This provides sufficient aerosol concentrations at longer durations of the experiment.

shape	Vertical cylinder
size	Inner diameter: 1 m / height: 4 m
volume	3.2 m ³
Lighting	16 fluorescent lamps, emitting > 320nm
temperature range	from -25°C to 25°C
operating pressure	ambient
relative humidity	2 - 80 %
Gas purity	Purified air N ₂ 80%, O ₂ 20%
Maximum purge rate	1.2 m ³ /h
Wall material	Glass (Duran, Schott) Teflon film (FEP 200A, 0.05mm)
Air Exchange Rate	0.25 - 2.5 h ⁻¹

2.2. Images



2.3. Publications

Ofner, J; Krüger, HU; Zetzsch, C; Grothe, H: Direct Deposition of Aerosol Particles on an ATR Crystal for FTIR Spectroscopy Using an Electrostatic Precipitator, *Aerosol Science and Technology*, 43(8), 794-798 (2009)

Sen, A; Siekmann, F; Krüger, HU; Zetzsch, C: Investigation of atmospheric nanoparticles: Impact of sea salt and fate of organic molecules adsorbed on alumina, *Phys. stat. sol.*, 243, 3546-3550 (2006)

Krüger, HU; Gavrillov, R; Liu, Q; Zetzsch, C: Entwicklung eines Persistenz-Messverfahrens für den troposphärischen Abbau von mittelflüchtigen Pflanzenschutzmitteln durch OH-Radikale; Schlussbericht zum Vorhaben UFOPLAN 201 67 424/02, (2005)

Palm, W; Elend, M; Krüger, U; Zetzsch, C: Atmospheric degradation of a semivolatile aerosol-borne pesticide: Reaction of OH with pyrifenoxy (an oxime-ether), adsorbed on SiO₂, *Chemosphere*, 38, 1241-1252 (1999)

Behnke, Wolfgang; Nolting, Friedrich; Zetzsch, Cornelius. An aerosol smog chamber for testing abiotic degradation of compounds with low volatility. *Pestic. Sci. Biotechnol., Proc. Int. Congr. Pestic. Chem.*, 6th (1987), Meeting Date 1986

For more publications, please click [here](#).

2.4. Access to the chamber under Eurochamp TA

Access to LOTASC is provided through Eurochamp-2 Transnational Access and other collaborations. Please contact us find the appropriate setup for new projects at LOTASC.

LOTASC offers access to various types of instruments. There is another Teflon chamber whose temperature can also be lowered down to 25°C, recently it has been combined with a Differential Optical Absorbance Spectroscopy (DOAS) within the collaboration with the Institute of Environmental Physics of the University of Heidelberg, to detect trace gases, mainly absorbing light in the visible and ultraviolet wavelength range, such as OH, HONO, NO₃, OClO, BrO, IO, NO₂, NO, and NH₃ [Platt and Stutz 2008]. There is a third chamber-Medium size glass chamber combined with White cell and long path FTIR absorption (normally at room temperature) as on-line technique and FTIR with ATR and DRIFTS as offline techniques. It is possible to study aerosol formation and processing on a molecular level.

Modifications of inlet lines or flanges can be provided on request. Access to workshops and laboratories can be provided after consultation. Status data of the chamber and the data of the installed instruments are available for the user.

3. Institution in charge of the laboratory facility

The Atmospheric Chemistry Research Laboratory was founded in 2003. It is part of the Bayreuth Center of Ecology and Environmental Research (BayCEER) in the Geoecology Department of the University of Bayreuth.

The main areas of research and tasks are:

- Atmospheric photochemistry of volatile and semi-volatile organic compounds
- Heterogeneous chemistry on secondary organic aerosols and HULIS
- Photochemistry of sea salt aerosol and halogen activation
- Integration of Chambers for Investigating Atmospheric Processes within the Infrastructure EUROCHAMP-2

UBT is partner 4 in Eurochamp-2.

3.1. Contact Information

Prof. Cornelius Zetzsch, phone: +49 921 55 5726, fax: +49 921 55 5729

Prof. Andreas Held, phone: +49 921 55 5723, fax: +49 921 55 5729

Forschungsstelle für Atmosphärische Chemie
University of Bayreuth
Dr.-Hans-Frisch-Straße 1-3
95440 Bayreuth, Germany

4. Additional Information

As mentioned in 2.4 Access to the chamber under Eurochamp-2 TA, there are two more chambers in our institute. One is LOTASC Teflon Chamber, the other is a medium size glass chamber combined with FTIR absorption.

LOTASC Teflon Chamber

It is mainly designed for halogen activation experiment (also on soil). GC-FID and a new HID detector are connected with the chamber for trace gas detection. Recently, it has been combined with a Differential Optical Absorbance Spectroscopy (DOAS) within the collaboration with the Institute of Environmental Physics of the University of Heidelberg, to detect trace gases, mainly absorbing light in the visible and ultraviolet wavelength range, such as OH, HONO, NO₃, OClO, BrO, IO, NO₂, NO, NH₃ et al. [Platt and Stutz 2008]. For the smog chamber experiments in Bayreuth a Czerny/Turner-spectrograph with a photodiode array detector is used in combination with a multi-reflection cell (White[1942 & 1976]). Two sets of 3 mirrors each are required for the set-up of the multi-reflection cell.

LOTASC Teflon Chamber

Medium size glass chamber combined with White cell and long path FTIR absorption (normally at room temperature) as on-line technique and FTIR with ATR and DRIFTS as offline techniques. It is possible to study aerosol formation and processing on a molecular level.



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Chambers CRAC1

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CRAC1: description and transnational access

1. Introduction

CRAC1 is a custom-built simulation chamber designed for laboratory-based investigations of atmospheric processes such as the oxidation of volatile organic compounds and secondary organic aerosol formation. **CRAC1** is part of the **Transnational Access of Eurochamp-2**.

2. Description of the research facility

CRAC1 is a 3.91 m³ (3,910 L) cylinder made of fluorine-ethene-propene (FEP) foil surrounded by UV-visible lamps. The chamber is operated using purified dry air at atmospheric pressure and ambient temperature. Water can be added to the chamber to vary the relative humidity. Between experiments the chamber is flushed with clean air. The chamber is equipped with a wide range of instrumentation for chemical analysis, including GC and GC-MS (Varian Saturn 2000) for the detection of organic reactants and products, automated analyzers for monitoring nitrogen oxides and ozone, and in situ FTIR spectroscopy (path length 230 m). A scanning mobility particle sizer (SMPS) consisting of a condensation particle counter (TSI 3022A) and an electrostatic classifier (TSI 3071A) is used to measure the number concentration and size distribution of aerosol particles.

The main areas of research supported by the UCC chamber are studies of the atmospheric oxidation of volatile organic compounds (VOCs) to determine rate coefficients, reaction products and secondary organic aerosol formation. One of the unique techniques currently available is a novel denuder-filter system coupled with GC-MS analysis for the simultaneous measurement of gas and particle phase VOC oxidation products. In EUROCHAMP 2 the UCC chamber will be equipped with two new analytical tools; an aerosol time-of-flight mass spectrometer (ATOFMS) for the on-line analysis of secondary organic aerosol and a custom-built cavity enhanced absorption spectroscopy (CEAS) system for the detection of nitrate radicals. Both techniques will be unique within the EUROCHAMP consortium and will therefore enable UCC to provide unique research opportunities in the areas of secondary organic aerosol and nitrate radical reactions respectively.

2.1. Technical data

shape	cylinder
size	diameter: 1.1 m / length: 4.1 m
volume	3.91 m ³
Surface to volume ratio	0.24 m
wall material	FEP foil (0.127 mm thickness)
lighting	36 lamps
gas purity	Dry purified air below 1 ppbv NO _x and hydrocarbons
maximum purge rate	0.15 m ³ min ⁻¹
temperature range	ambient temperature (293-298 K)
operating pressure	0.1 -1.0 mbar above ambient pressure

2.2. Images



2.3. Publications

Kourtchev, I., Bejan, I., Sodeau, J. R., and Wenger, J. C. Gas-phase reaction of (E) - β -farnesene with ozone: Rate coefficient and carbonyl products, *Atmospheric Environment*, 43, 3182-3190, 2009.

Cécile Coeur-Tourneur, Alexandre Tomas, Angélique Guilloteau, Françoise Henry, Frédéric Ledoux, Nicolas Visez, Véronique Riffault, John C. Wenger, Yuri Bedjanian Aerosol formation yields from the reaction of catechol with ozone *Atmospheric Environment*, 43, 2360-2365, 2009.

R.M. Healy, B. Temime, K. Kuprovskytė and J.C. Wenger Effect of Relative Humidity on Gas/Particle Partitioning and Aerosol Mass Yield in the Photooxidation of p-Xylene *Environmental Science & Technology*, 2009, 43, 1884-1889.

R.M. Healy, J.C. Wenger, A. Metzger, J. Duplissy, M. Kalberer and J. Dommen Gas/particle partitioning of carbonyls in the photooxidation of isoprene and 1,3,5-trimethylbenzene *Atmospheric Chemistry and Physics*, 2008, 8, 3215-3230.

Max R. McGillen, Trevor J. Carey, Alex T. Archibald, John C. Wenger, Dudley E. Shallcross and Carl J. Percival Structure-activity relationship (SAR) for the gas-phase ozonolysis of aliphatic alkenes and dialkenes *Physical Chemistry Chemical Physics*, 2008, 10, 1757-1768.

B. Temime, R.M. Healy and J.C. Wenger A Denuder-Filter Sampling Technique for the Detection of Gas and Particle Phase Carbonyl Compounds *Environmental Science & Technology*, 2007, 41, 6514-6520.

N. Carrasco, J-F. Doussin, M. P. O'Connor, J.C. Wenger, B. Picquet-Varrault, R. Durand-Jolibois and P. Carlier Simulation Chamber Studies of the Atmospheric Oxidation of 2-Methyl-3-Buten-2-ol: Reaction with Hydroxyl Radicals and Ozone under a Variety of Conditions *Journal of Atmospheric Chemistry*, 2007, 56, 33-55.

D.S. Venables, T. Gherman, J. Orphal, J.C. Wenger and A.A. Ruth High Sensitivity in situ Monitoring of NO₃ in an Atmospheric Simulation Chamber using Incoherent Broadband Cavity-Enhanced Absorption Spectroscopy *Environmental Science & Technology*, 2006, 40, 6758-6763.

G.M. Clifford and J.C. Wenger Rate coefficients for the gas-phase reaction of hydroxyl radicals with the dimethylbenzaldehydes *International Journal of Chemical Kinetics*, 2006, 38, 563-569.

G.M. Clifford, L.P. Thüner, J.C. Wenger and D.E. Shallcross Kinetics of the Gas-Phase Reactions of OH and NO₃ Radicals with Aromatic Aldehydes *Journal of Photochemistry and Photobiology A: Chemistry*, 2005, 176, 172-183.

L.P. Thüner, P. Bardini, G.J. Rea and J.C. Wenger Kinetics of the Gas-Phase Reactions of OH and NO₃ Radicals with Dimethylphenols *Journal of Physical Chemistry, A*, 2004, 108, 11019-11025.

2.4. Access to the chamber under Eurochamp TA

Visits will be typically 10-15 working days duration and organised at least 1 month in advance with the permanent scientists at UCC (John Wenger and Dean Venables). All equipment will be available to the users. The work will be treated as a collaborative research effort and joint authorship of any resulting papers or conference proceedings is expected. The users will work closely with the permanent scientists and the postdoctoral researchers and PhD students who regularly use the facility. All necessary training and guidance will be provided, from experimental design and procedures to data analysis. Requests for access to the CRAC1 chamber are processed centrally within EUROCHAMP 2.

3. Institution in charge of the laboratory facility

University College Cork (UCC) was founded in 1845 and today has over 14,500 students and 1,800 staff. It is the largest Irish university outside the capital, Dublin and has the highest research income of all the higher level institutions in the state. Research in environmental sciences is a high strategic importance in UCC and is facilitated by the recently established Environmental Research Institute (ERI).

UCC is partner 5 in Eurochamp-2.

3.1. Contact Information

Dr John Wenger, phone: +353 21 4902454

Dr Dean Venables, phone: +353 21 4902439

Department of Chemistry and Environmental Research Institute
University College Cork
Cork, Ireland

4. Additional Information

The research team at UCC currently offer excellent facilities and a stimulating research environment for visiting researchers. During 2005-2010 UCC hosted on average 4 visiting researchers per year from France, Spain and UK. This collaborative work has resulted in several research papers in the areas of kinetic and mechanistic studies of VOC oxidation (University of Paris, Universities of Manchester and Bristol) and the development of new methods for determining the composition of secondary organic aerosol (University of York).

Useful links:

<http://crac.ucc.ie>

<http://www.ucc.ie>

<http://eri.ucc.ie>



EUROCHAMP-2

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Chambers ICARE-SC

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ICARE-SC: description and transnational access

1. Introduction

The Atmospheric Reactivity Group of ICARE (CNRS-Orléans) has two medium sized chambers (7300 and 3400 l) and two small ones (about 200-300 l). These facilities are all dedicated to the investigation of the atmospheric chemical processes under realistic conditions. They are routinely used for kinetic measurements and product analysis of atmospheric processes using different analytical techniques. In the recent years, the experiments conducted with these chambers were focused on the atmospheric fate of biogenic and anthropogenic volatile organic compounds (VOCs) (gas phase processes and secondary organic aerosol, SOA, formation yields and chemical composition). The chambers were also used for the instrumentation intercomparison campaigns. These chambers are also designed to investigate the efficiency of photocatalytic materials used for air pollution reduction in the urban environment (glass, bitumen, ...).

To allow a fine comprehension of chemical transformation/evolution of wide range of chemical species, the chamber is equipped with state-of-the-art analytical park including specific monitors and instruments based on spectroscopic and chromatographic methods.

■ **ICARE smog chambers** are part of the ■ **Transnational Access of Eurochamp-2**.

2. Description of the research facility

2.1. Technical Data

2.1.1. Indoor 7300 l chamber

This medium sized chamber has a parallelepipedic shape and a volume of 7300 l (Figure 1). It is made of fluorene-ethene-propene (FEP) foil. The chamber is equipped with a wide range of analytical instrumentation and techniques to derive kinetic and mechanistic information. For photooxidation experiments, the gas mixture can be irradiated by UV-Vis lamps (centred on 254 nm and 365 nm and ORSAM ULTRA-VITALUX). A multi-reflection White type mirrors system is mounted inside the reactor and interfaced to an FT-IR spectrometer (Nicolet Magna 5700), which allows in situ monitoring of reactants and oxidation products in the ppm-ppb range (Figure 2). Analyses are also accomplished using different types of gas chromatographs equipped with, photo ionisation detector (PID) and mass spectrometry (ATD-GC-MS PerkinElmer Clarus 600) at ppb level measurement. A number of atmospheric key species are analyzed using specific monitors in the ppt-ppb range (e.g. O₃ (HORIBA, APOA-360 and 370), NO_x (HORIBA, APNA-360 and Thermo Environment 42i TL), HONO (LOPAP, QUMA-O3) and HCHO (Aerolaser AL 4021)). The chamber is also equipped with instrumentation for particle analysis. Particles size distributions can be measured by a SMPS (TSI3080/CPC3022A). Particles can be also collected on filters and then analysed by different techniques including GC-MS, HPLC (UV and fluorimetric detections) and ionic chromatography (Figure 3). The chamber can be combined with an aerosol flow reactor for particle specific production. Intercomparison campaigns can easily be carried out with this facility.

2.1.2. Outdoor 3400 l chamber

The ICARE sunlight irradiated Atmospheric Simulation Chamber, made of 200µm ETFE film, has a cubic shape, and a volume of 3400 liters (Figure 4). The facility is equipped with a J(NO₂) radiometer (Meteorologie Consult gmbh) and temperature/relative humidity sensors. A fan positioned inside the chamber permits to obtain a homogeneous mixing in less than 2 minutes. Gas phase analysis of the gas mixtures can be accomplished using specific monitors for inorganic species (NO_x, O₃, HONO, HCHO). VOCs are analysed with gas chromatograph coupled with photoionisation detector (GC-PID), and can be also collected on cartridges and then further analysed by ATD-GC-MS PerkinElmer Clarus 600, High Performance Liquid Chromatography (HPLC, UV and fluorimetric detections) and Ion Chromatography (IC). Particle physical properties are also examined: the particles size distribution can be measured by a SMPS (TSI3080/CPC3022A). Particles can be collected on filters and analyzed by different techniques such as IC and HPLC.

The chamber can be covered by a black and opaque cloth in order to protect the chamber from light radiation when needed. This cloth can be easily removed in less than 10 seconds to expose the chamber to sunlight irradiation.

2.1.3. Indoor 275 l chamber

The 275 L indoor Atmospheric Simulation Chamber made of Teflon has a cubic shape. It is equipped with a number of inlets and outlets for the gas injection (air, NO-NO₂, O₃, ...) and analysis (NO-NO₂, O₃, ...). The chamber is placed in a box with internal faces covered with aluminium and equipped with a ventilation system which allows homogenization of the internal temperature. An ULTRA-VITALUX 300W (OSRAM) is used to simulate solar radiations (Figure 5).

2.1.4. Indoor 200 l chamber

The experimental set-up consists of a 200 L FEP Teflon chamber surrounded by six germicide lamps (Sylvania G30W) and six black lamps (Phillips, TL 20W/05). The bag is suspended in a wooden box with internal faces covered by aluminium foil. Reactants are introduced in the chamber by streaming purified air through a calibrated glass bulb. Gas phase chemical composition can be monitored at any time over the course of the reaction using the analytical equipment connected to the chamber: Gas Chromatography coupled to a Flame Ionisation Detector (GC-FID, Star 3800 CX, Varian), a Gas Chromatography coupled to Mass spectrometry (GC-MS, Saturn 2000, Varian) and a Infra Red Spectrometer (MAGNA-IR 550, series II) for measurement at ppm level.

2.2. Images



2.3. Publications

A detailed list of publications is provided [here](#).

2.4. Access to the chamber under Eurochamp TA

Access to the ICARE chambers is provided through Eurochamp-2 Transnational Access and other collaborations. Please contact us for more information about the use of our chambers.

The ICARE Chambers are equipped a wide range of modern analytical instrumentation and techniques (the list can be found [here](#)). There are also possibilities to host instrumentations from partners (for tests, intercalibration). Modifications can be made to the chambers if requested to host the visiting analytical tools.

3. Institution in charge of the laboratory facility

■ **ICARE-CNRS (Orléans)** is ■ **partner 6** in Eurochamp-2.

3.1. Contact Information

✉ Wahid Mellouki, phone: (00)33238257612

✉ Véronique Daële, phone: (00)33238255494

ICARE, CNRS
1C, Avenue de la recherché scientifique 45071 Orléans cedex 02, France

4. Additional Information

<http://era-orleans.org/ERA-TOOLS/index.php?accueil>
<http://era-orleans.org/eradb/index.php>



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Chambers PSI-SCAC

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PSI-SCAC: description and transnational access

1. Introduction

The PSI Simulation Chamber for Atmospheric Chemistry is a medium sized indoor chamber. It is a tool to investigate atmospheric processes like gas phase oxidation mechanisms, particle nucleation, aerosol formation, composition and ageing. The facility is equipped with a large suite of state of the art instruments. **PSI-SCAC** is part of the **Transnational Access of Eurochamp-2**.

2. Description of the research facility

The PSI SCAC provides a platform to investigate atmospheric processes at high as well as ambient relevant concentrations of precursors. These can be volatile organic compounds or complex mixtures like diesel exhaust or wood burning emissions. Specific projects and questions addressed so far include:

- Investigation of oligomer formation in SOA
- Determination of SOA yields from various precursor compounds
- Investigation of the influence of organics and sulfuric acid on nucleation
- Investigation of cloud forming potential of SOA
- Intercomparison of instruments
- Investigation of composition, gas/particle partitioning and volatility of SOA
- Evaluation of photochemical mechanisms
- Investigation of SOA formation from diesel and wood burning emissions

2.1. Technical data

The chamber is a 27-m³ (3×3×3 m) flexible bag made of 125 µm Teflon® fluorocarbon film (FEP). The bag is suspended in a temperature controlled wooden enclosure having dimension 4×5×4 m (L×W×H). Temperature can be stabilized to 1°C within the range of 17 to 25 °C. Four xenon arc lamps (4 kW rated power, lumens each) are used as light source. The light is filtered with borosilicate glass plates to reduce the high actinic UV below the wavelength of 300 nm and to simulate the solar light spectrum. A NO₂ photolysis rate of min-1 is obtained.

Purified air is supplied by an AADCO (737-250 series, AADCO Instruments, Inc., USA) pure air generation system. Gaseous components (NO, NO₂, gaseous organic compounds) can be delivered to the smog chamber. An ozone generator can provide ozone levels from ppb to ppm concentrations in the chamber. The chamber can be humidified with ultrapure water up to 80 %RH. A particle generation system is available for seed particle experiments. Three manifolds (inlet and outlet) made of stainless steel and Teflon® allow for easy installation of additional inputs and sampling lines.

The smog chamber is equipped with a fixed set of instruments which are regularly operated. Additionally, there are many special state of the art instruments of our own which are available for specific campaigns.

Aerosol physical parameters	
Condensation Particle Counter (CPC)	total particle number concentration
SMPS (TSI 3071 and 3010 CPC)	number weighted particle size distribution
Volatility Tandem Differential Mobility Analyzer (V-TDMA)	particle volatility
Hygroscopicity Tandem Differential Mobility Analyzer (H-TDMA)	Hygroscopic growth of particles
DMT cloud condensation nuclei counter	cloud condensation nuclei (CCN) activity
Aerosol chemical composition	
Ion Chromatograph coupled to a Mass Spectrometer	Inorganic ions and organic acids
High Resolution time of flight Aerosol Mass Spectrometer (HR-ToF-AMS, Aerodyne)	Inorganic Ions, fingerprints of organic composition, O:C, H:C ratios
Aethalometer (AE31, Magee Scientific Company)	Black carbon
SP2	Black carbon
Gas phase chemical composition	
Ozone analyzer	ozone(O ₃)
Thermo Environmental Instruments 42C trace level NO _x analyzer	oxides of nitrogen (NO, NO ₂)
Proton Transfer Reaction Mass Spectrometer (PTR-MS)	m/z of volatile organic compounds
Ion Chromatograph coupled to a Mass Spectrometer	SO ₂ , HNO ₃ , HONO, organic acids
LOPAP	HONO
Hantzsch Monitor	HCHO
AL2001 CL Peroxide	H ₂ O ₂

2.2. Images



2.3. Publications

Kalberer, M., D. Paulsen, M. Sax, M. Steinbacher, J. Dommen, A. S. H. Prévôt, R. Fisseha, E. Weingartner, V. Frankevich, R. Zenobi, and U. Baltensperger (2004), Identification of Polymers as Major Components of Atmospheric Organic Aerosols, *Science*, 303, 1659-1662.

Paulsen, D., J. Dommen, M. Kalberer, A. S. H. Prévôt, R. Richter, M. Sax, M. Steinbacher, E. Weingartner, and U. Baltensperger (2005), Secondary Organic Aerosol Formation by Irradiation of 1,3,5-Trimethylbenzene-NO_x-H₂O in a New Reaction Chamber for Atmospheric Chemistry and Physics, *Environ. Sci. Technol.*, 39, 2668-2678.

Gross, D. S., M. E. Gälli, M. Kalberer, A. S. H. Prevot, J. Dommen, J. Duplissy, A. Gascho, A. Metzger, M. R. Alfarra, K. Gaeggeler, and U. Baltensperger (2006), Real time measurement of oligomeric species in secondary organic aerosol with the aerosol time-of-flight mass spectrometer, *Anal. Chem.*, 78, 2130-2137.

Metzger, A., Dommen, J., Gaeggeler, K., Duplissy, J., Prevot, A., Kleffmann, J., Elshorbany, Y., Wisthaler, A., Baltensperger, U. (2008), Evaluation of 1,3,5 trimethylbenzene degradation in the detailed tropospheric chemistry mechanism, MCMv3.1, using environmental chamber data. *Atmos. Chem. Phys.*, 8, 11567-11607.

Metzger, A.; Verheggen, B.; Dommen, J.; Duplissy, J.; Prevot, A. S. H.; Weingartner, E.; Riipinen, I.; Kulmala, M.; Spracklen, D. V.; Carslaw, K. S.; Baltensperger, U. (2010), Evidence for the role of organics in aerosol particle formation under atmospheric conditions. *Proc. Natl. Acad. Sci.*, doi:10.1073/pnas.0911330107.

A detailed list of publications is provided [here](#).

2.4. Access to the chamber under Eurochamp TA

Access to PSI SCAC is provided through Eurochamp-2 Transnational Access and other collaborations. Interested users should contact us to discuss their interest and ideas. Typically, measurements are performed in a collaborative effort. Users can bring their instruments to our chamber. Modifications of inlet lines can be provided on request. Access to laboratories can be provided after consultation.

3. Institution in charge of the laboratory facility

The Paul Scherrer Institute, PSI, is the largest research centre for natural and engineering sciences within Switzerland, with its research activities concentrated on three main subject areas: Structure of Matter, Energy and the Environment, and Health. PSI belongs as an autonomous institution to the Swiss ETH domain. The PSI SCAC is operated by the Laboratory of Atmospheric Chemistry (LAC).

PSI is partner 7 in Eurochamp-2.

3.1. Contact Information

Prof. Urs Baltensperger, phone: +41 56 310 24 08

Dr. Josef Dommen, phone: +41 56 310 29 92

Paul Scherrer Institute
Laboratory of Atmospheric Chemistry
5232 Villigen, Switzerland

4. Additional Information

More information can be found on the internet.

[Paul Scherrer Institute](#)
[Laboratory of Atmospheric Chemistry](#)
[PSI SCAC](#)



EUROCHAMP-2

Integration of EUROpean Simulation CHAMbers for Investigating Atmospheric Processes

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Chambers AIDA

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AIDA: description and transnational access

1. Introduction

The large aerosol and cloud simulation facility AIDA (Aerosols Interaction and Dynamics in the Atmosphere) in Karlsruhe is a tool for investigating physical and chemical aerosol processes which have strong impacts on atmospheric chemistry, new particle formation, cloud microphysics, and aerosol-climate interactions. A unique feature is the large range of accessible temperatures from 183 K to 323 K together with operation at reduced pressure and a comprehensive set of trace gas, aerosol and cloud instrumentation. Thus, aerosol and cloud experiments can be carried out in the full range of tropospheric and stratospheric temperatures and pressures. Ice and water supersaturated conditions are accessible via controlled pumping expansion cycles. Furthermore, the chamber can be evacuated for cleaning and pre-conditioning purposes Access to [AIDA](#) is supported by [Transnational Access of Eurochamp-2](#).

2. Description of the research facility

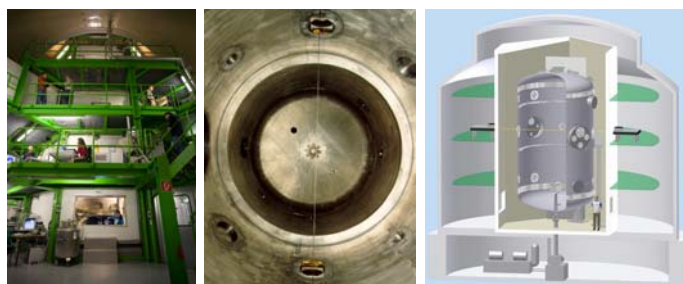
The AIDA facility comprises the large 84.5 m³ volume aluminium aerosol and cloud simulation chamber AIDA and the 3.9 m³ volume stainless steel aerosol preparation and characterisation chamber NAUA, both in the same building and connected to each other. The AIDA chamber can be operated at variable pressure (0.01 to 1000 hPa), temperature (+50°C to -90°C), and humidity conditions, including supersaturations with respect to ice and liquid water. Its capabilities to simulate upper tropospheric/lower stratospheric conditions and to generate supersaturations in a large volume are unique in Europe. The AIDA facility is equipped with an extensive suite of state of the art instruments, both commercial and custom built (<http://imk-aida.fzk.de/facility/>). It provides an excellent infrastructure in terms of optical, physical and other instrumentation to carry out, together with external partners, comprehensive studies of aerosol processes, and to evaluate their impact on air quality and climate on various scales. Research areas normally supported at the ADIA facility include investigation and modelling of aerosol dynamics, aerosol optical properties, aerosol chemistry, and aerosol-cloud interactions. This includes studies of tropospheric, stratospheric, and mesospheric clouds under both static and dynamic expansion conditions. Analysis of the AIDA experiments is supported with the AIDA database and the aerosol models (NACHE, MAID, and COSIMA) which are continuously improved and extended.

2.1. Technical data

Main part of the AIDA chamber is an evacuable aluminium cylinder located inside a temperature controlled housing. The air inside the housing is cools or heats the vessel with 3-4 K/h to temperatures between 183 and 323 K. Under static conditions the temperature gradients are less than ±0.3 K over the whole cylinder. The vacuum system allows evacuating the chamber within ~90 minutes to 1 Pa final pressure.

shape	cylinder
size	diameter: 4 m / height: 7.5 m
volume / inner surface	84.5 m ³ / 103 m ²
wall material	Aluminium (AlMg ₃)
temperature range	183 K - 323 K
operating pressure	ambient

2.2. Images



2.3. Publications

A detailed list of publications is provided [here](#).

2.4. Access to the chamber under Eurochamp TA

The AIDA facility is accessible, e.g. for joint research projects or measurement campaigns. Suggestions for new research topics/experiments are welcome. Access to AIDA is supported through EUROCHAMP-2 Transnational Access (TA) and other collaborations. Please contact us find the appropriate setup for new projects at AIDA.

Usually users access the AIDA facility with their instruments for a joint measurement campaign of 2-4 weeks duration. The results will be discussed at workshops, presented at conferences, and published in peer reviewed journals. Co-authorship should be

offered to all AIDA team members and external partners contributing significant amount of data and scientific work to the respective paper. The planning and scheduling of the measurement campaigns is done about a year in advance of the activity by discussing scientific goals and technical details with the participants. For this purpose planning workshops will be organised. New users of the facility may also suggest major research topics and organise respective planning workshops. Final decisions about the research topics addressed and the scheduling of campaigns are made by the AIDA team.

AIDA offers access for various types of instruments. These instruments can be placed either inside the vacuum chamber, inside the thermostated housing, or on 4 platform levels surrounding the chamber housing. See Fahey et al. (2009) for an example of how the instruments can be connect to AIDA for an instrument intercomparison. Typically stainless steel tubes ranging into the chamber are used for sampling. Modifications of inlet lines or flanges can be provided on request.

3. Institution in charge of the laboratory facility

The Atmospheric Aerosol Research Department (IMK-AAF) is one of four departments of the Institute of Meteorology and Climate Research (IMK) of the Karlsruhe Institute of Technology (KIT), Germany. KIT is a University of the State of Baden-Wuerttemberg in Germany and a National Research Center of the Helmholtz Association (HGF). The head of the Atmospheric Aerosol Research Department, Prof. Thomas Leisner, is also Professor at the Institute of Environmental Physics at the University of Heidelberg.

■ KIT is ■ partner 8 in Eurochamp-2.

3.1. Contact Information

■ Dr. Harald Saathoff, phone: +49 7247 82 2897

■ Dr. Ottmar Möhler, phone: +49 7247 82 4287

Karlsruhe Institute of Technology (KIT)
Institute for Meteorology and Climate Research (IMK)
Atmospheric Aerosol Research Division (AAF)
Hermann-von-Helmholtz-Platz 1
76344 Eggenstein-Leopoldshafen, Germany

4. Additional Information

n.a.



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Chambers HIRAC

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HIRAC: Description and transnational access

1. Introduction

The Highly Instrumented Reactor for Atmospheric Chemistry, [HIRAC](#), is based in the School of Chemistry at the University of Leeds, UK. HIRAC is funded by the Natural Environment Research Council, NERC, to carry out experiments which bridge the divide between the study of elementary reactions in the lab, and large scale field work. Uniquely HIRAC allows researchers the ability to simultaneously control temperature, pressure and photolysis rates during experiments. [HIRAC](#) is part of the [Transnational Access of Eurochamp-2](#).

2. Description of the research facility

HIRAC carries out a range of gas phase experiments designed to compliment the range of atmospheric chemistry related research being undertaken at the University of Leeds in the form of field, laboratory and theoretical studies. The research carried out in HIRAC covers three major objectives: i) Mechanism development linked to the Master Chemical Mechanism. ii) Field instrument development and calibration. iii) Kinetics and Structural Activity Relationship (SAR) development. More information about experiments being carried out in HIRAC can be found [here](#).

2.1. Technical data

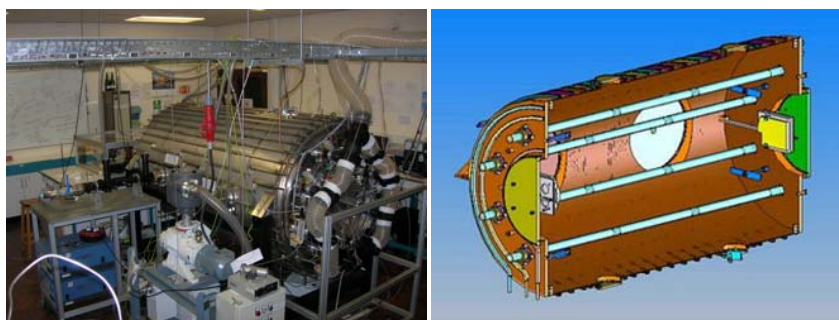
Detailed descriptions of HIRAC can be found [here](#) and in Glowacki *et al.* (ACP, 7, pp. 5371-5390, 2007). Briefly, HIRAC is a stainless steel cylinder with internal dimensions of 2.0 m long and 1.2 m diameter giving a total volume of $\sim 2.25 \text{ m}^3$. Due to its strong stainless steel construction experiments can be carried out over a range of pressures of any desired bath gas up to 1 atm. Partial cleaning of the chamber between experimental runs is achieved by a rotary pump backed roots blower. Thorough mixing of reaction mixtures is achieved by four low-vibration circulation fans giving mixing times of $\leq 70 \text{ s}$. HIRAC will undergo the installation of a temperature control system in 2010 which will enable temperature changes within the chamber from $\sim -70 \text{ }^\circ\text{C}$ to $+70 \text{ }^\circ\text{C}$.

Light for photochemical studies can be provided by several different types of lamps (Philips TLK40W/05 actinic UV blacklamps, GE G55T8 / OH 7G UVC lamps and Philips TL 40W/12 RS SLV UV-B medical therapy lamps) which have different spectral profiles and intensities in the UV region. The lamps are housed in eight quartz tubes mounted radially inside the reactive volume parallel to the chamber's principle axis. A combination of experimental, analytical and ray tracing results have shown that $j(\text{NO}_2)$ is within $\pm 15\%$ of the average for $\sim 75\%$ of HIRAC's volume confirming the homogeneity of the radiation profile within the chamber.

HIRAC is fitted with a full suite of instrumentation to allow accurate and thorough characterisation of the chemistry occurring inside the chamber during experiments. Along with a number of devices for measuring temperature and pressure, HIRAC is also fitted with the instruments detailed in the table below and [here](#):

Instrument	Species detected	Detection limit	Time resolution
FAGE <i>Fluorescence Assay by Gas Expansion</i>	OH and HO ₂	0.1 - 0.02 pptv	1 - 30 s
CRDS <i>Cavity Ring Down Spectroscopy</i>	NO ₃	6 pptv	4 s
FTIR <i>Fourier Transform Infra-red Spectroscopy</i>	O ₃ , CH ₃ CHO, CH ₄ , HCHO	60 - 80 pptv	60 s
GC-FID <i>Gas Chromatography / Flame Ionisation Detection</i>	<i>Organic species e.g.:</i> CH ₄ , C ₆ H ₁₂ , C ₅ H ₈ , C ₃ H ₆ O ₂	0.01 - 0.05 ppmv	20 s averages at 2 min resolution
Commercial Analysers	NO _x (=NO+NO ₂) O ₃ H ₂ O	50 pptv 1 ppbv 2.5 % RH	120 s 20 s 10 s

2.2. Images





2.3. Publications

A detailed list of publications is provided [here](#).

2.4. Access to the chamber under Eurochamp TA

Requests for access to the HIRAC chamber are processed centrally within EUROCHAMP-2 and must be made a minimum of 6 months prior to the proposed campaign. Planning of experiments and use of chamber instrumentation will be agreed prior to arrival. Typically experimental campaigns will be collaborative in nature. Experiments will have access to all equipment described in the table above for the duration of the stay. HIRAC instrumentation will be operated by Leeds personnel or training will be provided. Campaigns would be expected to last a minimum of 5 days and up to 3 weeks. This duration includes setup time and any time required to return the chamber to its original condition.

Many of the radical detection techniques are unique for a chamber of this size and HIRAC provides an ideal platform to test ideas before applying in larger outdoor chambers. The range of temperature and pressure control will be an attractive feature for those involved in mechanistic studies or interested in testing aircraft based instrumentation. HIRAC has deliberately been designed with a variety of different access ports and should be able to accommodate a variety of external apparatus for intercomparisons / calibrations or focused campaigns on a particular topic.

3. Institution in charge of the laboratory facility

The [University of Leeds](#) is one of the largest centres for atmospheric science in the UK and is recognised internationally for its excellence in atmospheric science research. The [School of Chemistry](#) was ranked 8th in the UK in the Research Assessment Exercise 2008 (RAE2008) and has an internationally leading reputation in atmospheric chemistry for field measurements of atmospheric composition, laboratory studies of chemical kinetics and photochemistry, and the development of numerical models and chemical mechanisms, including the [Master Chemical Mechanism](#). The Atmospheric Chemistry Group consists of 5 senior experimental atmospheric chemists with a total research group size of ~30, and is closely associated with the Institute for Climate and Atmospheric Science (ICAS) in the School of Earth and Environment. Leeds also plays host to the National Centre for Atmospheric Science (NCAS) from which it receives significant support.

LEEDS is partner 9 in Eurochamp-2.

3.1. Contact Information

Prof. Paul Seakins, phone: +44 113 343 6568

Dr. Shona Smith, phone: +44 113 343 6550

School of Chemistry
University of Leeds
Leeds
LS2 9JT
UK

4. Additional Information

n.a.



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Chambers SP-chambers

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SP chambers: description and transnational access

1. Introduction

SP chambers are a tool for qualitative and quantitative investigation of indoor air pollution and indoor air chemistry. The goal is the determination of emissions and reactions of organic compounds present in indoor air with ozone under controlled conditions representative for indoor environments and their effect on indoor air quality. The chambers can also be used for exposure studies involving materials, subjects and humans. **SP chambers** are part of the **Transnational Access of Eurochamp-2**.

2. Description of the research facility

SP operates three types of chambers: a walk-in chamber with a volume of 22 m³, STORA, an open/close 1 m³ chamber, LILLA, and a microchamber FLEC (Field and Laboratory Emission Chamber) with a volume of 35 cm³. The chambers are equipped with control units for temperature, relative humidity and ventilation rate, and several inlet and sampling ports.

The following research questions are addressed:

- Ozone-initiated chemical reactions in indoor air
- Particles and gaseous products from indoor chemical reactions and their organic composition
- Deposition and surface reactions on building and interior equipment materials
- Characterization of emissions from materials and subjects

The specific characteristics of the SP chambers are:

- Simulation of realistic indoor air conditions with respect to temperature, relative humidity and air exchange rates
- Emission measurements, exposure experiments and reactions in the gas phase and on surfaces

The chamber design and operation are compatible with several international standards. FLEC complies with ISO 16000-10, LILLA 1 m³ chamber with ISO 16000-9 and STORA 22 m³ chamber with ASTM E1333.

2.1. Technical data

The inside walls of the chambers are all constructed from stainless steel. Compressed, dried and purified ambient air is used in the experiments/tests. Technical details for the different chambers can be found [here](#) and in the following tables:.

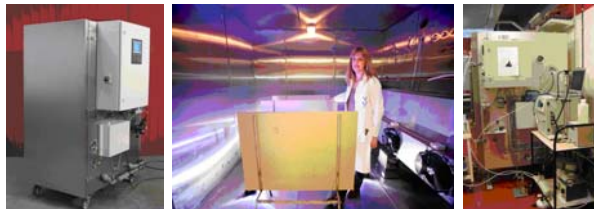
Name	STORA
shape	box
size	3.2 x 2.9 x 2.4 meters
volume /inner surface	22.4 m ³ /48.01m ²
wall material	stainless steel
temperature range	20 - 45 C
operating pressure	ambient
relative humidity	2 - 80 %
Air Exchange Rate	0.25 - 2.5 h ⁻¹

Name	LILLA
shape	box
size	65 x 102 x 150 cm
volume /inner surface	0.99 m ³ /6.337 m ²
wall material	stainless steel
temperature range	18 - 30 C
operating pressure	ambient
relative humidity	2 - 80 %
Air Exchange Rate	0.1 - 4 h ⁻¹

Name	FLEC
shape	circular
diameter	20 cm

volume /inner surface	35 cm ³ /177 cm ²
wall material	stainless steel
temperature range	18 - 30 C
operating pressure	ambient
relative humidity	2 - 80 %
Air Exchange Rate	170 - 700 h ⁻¹

2.2. Images



2.3. Publications

Relevant publications illustrating the research possibilities of our chambers:

Giorgi R., Chelazzi D., Frantini E., Langer S., Niklasson A., Rådemar M., Svensson J.-E., Baglioni P.: Nanoparticles of Calcium Hydroxide for Wood Deacidification: Decreasing the emissions of organic acid vapours in church organ environments. *Journal of Cultural Heritage* 2009, 10(2), 206-213.

Langer S., Moldanová J., Arrhenius, K., Ljungström E., Ekberg, L.: Ultrafine Particles Produced by Ozone/Limonene Reactions in Indoor Air under Low/Closed Ventilation Conditions. *Atmospheric Environment* 2008, 42(18), 4149-4159.

2.4. Access to the chamber under Eurochamp TA

Access to SP chambers is provided through Eurochamp-2 Transnational Access and other collaborations. Please contact us to find the appropriate setup for new projects at SP. We offer access to various instruments for generation, sampling and analysis of volatile organic compounds, ozone and particles. Guest instruments can be fitted in/to the chambers and modification of inlet and sampling lines can be provided on request.

3. Institution in charge of the laboratory facility

SP Sveriges Tekniska Forskningsinstitut AB (SP Technical Research Institute of Sweden AB) is owned by RISE Research Institutes of Sweden Holding AB under the Ministry of Industry. SP is the national institute for technical evaluation, research, testing, certification, metrology and calibration, and is working closely with large and small companies, universities, institutes of technology and other organisations. SP's activities cover a wide technical range, with about 30 technology areas organised in eight inter-working technical departments. We are some 900 co-workers who base our services on competence, efficiency, impartiality and international acceptance. SP's headquarters are located in Borås, close to Gothenburg on the West Coast of Sweden.

SP Chemistry and Materials Technology conducts research, testing, calibration and certification in a wide range of areas related to analytical chemistry and materials technology. Core competences include organic and inorganic analyses of major and trace components in gases, liquids and solids, environmental analyses, characterization (chemical and/or physical) of indoor air, materials, surfaces and interfaces. The Department has a strong experimental programme, with a range of state-of-the-art facilities for field and laboratory measurements. Important activity is chemical metrology -- quality assurance and quality control of the measurements in chemical laboratories and activities ensuring the accreditation of the laboratory by SWEDAC -- the Swedish Accreditation Agency.

■ SP is ■ partner 10 in Eurochamp-2.

3.1. Contact Information

✉ Dr. Sarka Langer, phone: +46 10 516 5287

✉ Dr. Karine Arrhenius, phone: +46 10 516 5728

4. Additional Information

n.a.



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Chambers GPP

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GPP: description and transnational access

1. Introduction

The interuniversity laboratory of Atmospheric Systems has developed since the early 90s a simulation chamber which is dedicated to gas-phase processes from which more than 20 papers have been published. The gas phase LISA chamber which is dedicated to the study of gas-phase processes is an evacuable Pyrex photoreactor equipped with two in situ spectrometry path ways. This chamber has been developed for gas-phase reactivity studies but is also a unique infrastructure for mid-high resolution spectroscopic studies in both UV-visible and IR spectral ranges which makes this facility a powerful tool for satellite data validation. GPP is part of the [Transnational Access of Eurochamp-2](#).

2. Description of the research facility

2.1. Technical data

The gas phase LISA chamber which is dedicated to the study of gas-phase processes is an evacuable Pyrex photoreactor of 977 liters. The surface-to-volume ratio is equal to 9 m^{-1} . The reactor is surrounded by two sets of 40 fluorescent tubes (Philips TL05 and TL03) and 16 arc lamps that provide an irradiation with a broad spectral range from 300 to 600 nm. This reactor is equipped with two in situ multiple reflection optical systems interfaced to a FTIR spectrometer and to an UV-visible absorption spectrometer. The IR channel allows one to acquire spectra between 600 and 4000 cm^{-1} with a resolution of 0.013 cm^{-1} and an optimum optical path length of 660 m. The UV-visible channel allows to acquire spectra from 250 to 650 nm with a resolution of 0.15 nm and an optimum optical path length of 72 m. Complementary analytical devices (GC-MS, HPLC, monitors) are also available.

2.2. Images



2.3. Publications

Gratien A., M. Lefort, B. Picquet-Varrault, J. Orphal, J-F. Doussin and J-M. Flaud ; Experimental intercomparison of the absorption cross-sections of nitrous acid (HONO) in the ultraviolet and mid-infrared spectral regions, *Journal of Quantitative Spectroscopy and Radiative Transfer*, Volume: 110, Issue: 4-5, Pages: 256-263; 2009

Picquet-Varrault B., Scarfogliero M., Ait Helal W. and Doussin J-F., Re-evaluation of the rate constant for the reaction propene + NO₃ by absolute rate determination, *International Journal of Chemical Kinetics*, Volume 41, Issue 2, , Pages: 73-81, 2009

Scarfogliero, M., B. Picquet-Varrault, J. Salce, R. Durand-Jolibois and J-F. Doussin. Kinetic and mechanistic study of the gas-phase reactions of a series of vinyl ethers with the nitrate radical. *Journal of Physical Chemistry A*, 110, (38), pp. 11074-11081, 2006.

Doussin, J-F., D. Ritz, R. Durand-Jolibois, A. Monod and P. Carlier. Design of an environmental chamber for the study of atmospheric chemistry: New developments in the analytical device. *Analyst*, 25, (7), pp. 236-242, 1997

2.4. Access to the chamber under Eurochamp TA

Requests for access to the PARIS12 chamber are processed centrally within EUROCHAMP 2. The users will have access to all equipments of the infrastructure for the duration of the stay. The planning of the experiments will be decided jointly between the staff of LISA and the visitors. The minimum duration of the stay is 5 days but typical duration are 1-3 weeks. Users will work directly with LISA staff i.e. Pr. Jean-François Doussin, Dr. Yasmine Katrib-Kouchir, Edouard Pangui (Ing), Dr. Emilie Perraudin, Dr. Sebastien Perrier or Dr. Bénédicte Picquet-Varrault. Unit of access is defined as one day spent by any group at the PARIS12 chamber. The full time period is counted from the day of arrival until the day of departure; the eligible period thus includes also the preparatory phase to set up instruments at the beginning. The cleaning periods are counted as well (generally performed overnight, it can sometime be longer depending the experiment performed or the sensitivity of the experiment planned to the background reactivity). Of course, the chamber cannot be used for other purposes during this cleaning procedure. The access include consumables, maintenance, staff for experiment days and preparatory work (about 25% of experiment time) at the facility.

3. Institution in charge of the laboratory facility

➤ **PARIS12** is ➤ **partner 11** in Eurochamp-2.

3.1. Contact Information

➤ **Prof. Jean-François Doussin**, phone: +33 1 45 17 15 85, fax: +33 1 45 17 15 64

➤ **Dr. Bénédicte Picquet-Varrault**, phone: +33 1 45 17 15 86, fax: +33 1 45 17 15 64

Equipe MEREIA (Reactivity and Measurements of Species of Atmospheric Interest)
Laboratoire Interuniversitaire des Systèmes Atmosphériques Faculté des Sciences


61, avenue du Général De Gaulle, F-94010 Créteil Cedex, FRANCE

4. Additional Information

n.a.

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Chambers CESAM

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CESAM: description and transnational access

1. Introduction

The CESAM reactor has been designed to investigate the interactions (exchange, condensation, chemical reactivity, dissolution) between gas and solid phases. As the radical sources we will be investigated are photo-induced, a great care has been taken with the realism of the irradiation. This device is equipped with up-to-date analytical tools to characterize the chemical and the physical state of gas, aqueous and solid phases. Moreover, this chamber is located in a 170 m² hall based in the ground floor which enables an easy access for heavy instruments (PTR-MS, AMS, IRMS, ...).

One key feature of this chamber is that its versatility enable numerous connections to the chamber for other instruments, making CESAM a good platform for intercalibration campaigns. Another key feature is the possibility to generate cloud/fog inside the chamber to study hydrometeores photochemistry or aerosol ageing during awapo-condensation processes. Furthermore, it is possible to study atmospheric photochemistry at various altitude : Thank to a filter set-up, it is possible to adjust the light source in order to work with solar spectra representatives from ground level to 60 km altitude. CESAM is part of the [Transnational Access of Eurochamp-2](#).

2. Description of the research facility

2.1. Technical data

This chamber (made of stainless steel) offers a volume of 4.2 m³ with a double walls design allowing a cooling of the chamber. The surface-to-volume ratio is equal to 4.3 m⁻¹. To produce an irradiation flux as close as possible of the solar spectrum, three 4kW high pressure xenon arc lamps are located above large quartz windows. The analytical devices available on this chamber include a long path in-situ FTIR, GC-MS, HPLC derivatization and monitors for gas-phase composition. Particulate size distribution is measured by SMPS and optical partical spectrometer (VELAS) which combinaison offer information from 10 nm to 20 micron. Chemical composition analysis of particules is measured by off-line (SFE-GC-MS).

2.2. Images



2.3. Publications

Wang, J., Doussin, JF, Perrier S., Perraudin E., Katrib Y., Pangui E., Picquet-Varrault B. ; Design of a new multi-phase experimental simulation chamber for atmospheric photosmog formation, aerosol and cloud chemistry investigations, submitted to Atmospheric Measurement Techniques

Chiappini, L., E. Perraudin, R. Durand-Jolibois and J.F. Doussin. Development of a supercritical fluid extraction-gas chromatography-mass spectrometry method for the identification of highly polar compounds in secondary organic aerosols formed from biogenic hydrocarbons in smog chamber experiments. Analytical and Bioanalytical Chemistry, 386, (6), pp. 1749-1759, (2006)

2.4. Access to the chamber under Eurochamp TA

Requests for access to the PARIS12 chamber are processed centrally within EUROCHAMP 2. The users will have access to all equipments of the infrastructure for the duration of the stay. The planning of the experiments will be decided jointly between the staff of LISA and the visitors. The minimum duration of the stay is 5 days but typical duration are 1-3 weeks. Users will work directly with LISA staff i.e. Pr. Jean-François Doussin, Dr. Yasmine Katrib-Kouchnir, Edouard Pangui (Ing), Dr. Emilie Perraudin, Dr. Sebastien Perrier or Dr. Bénédicte Picquet-Varrault.

Unit of access is defined as one day spent by any group at the PARIS12 chamber. The full time period is counted from the day of arrival until the day of departure; the eligible period thus includes also the preparatory phase to set up instruments at the beginning. The cleaning periods are counted as well (generally performed overnight, it can sometime be longer depending the experiment performed or the sensitivity of the experiment planned to the background reactivity). Of course, the chamber cannot be used for other purposes during this cleaning procedure. The access include consumables, maintenance, staff for experiment days and preparatory work (about 25% of experiment time) at the facility.

3. Institution in charge of the laboratory facility

➤ **PARIS12** is **partner 11** in Eurochamp-2.

3.1. Contact Information

✉ Prof. Jean-François Doussin, phone: +33 1 45 17 15 85, fax: +33 1 45 17 15 64

✉ Dr. Bénédicte Picquet-Varrault, phone: +33 1 45 17 15 86, fax: +33 1 45 17 15 64

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Laboratoire Interuniversitaire des Systèmes Atmosphériques Faculté des Sciences
61, avenue du Général De Gaulle, F-94010 Créteil Cedex, FRANCE

4. Additional Information

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Chambers LACIS

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LACIS: description and transnational access

1. Introduction

1. Introduction The Leipzig Aerosol Cloud Interaction Simulator (LACIS) is a unique facility to study aerosol cloud interactions. It was designed and built to achieve a better understanding of the mechanisms controlling aerosol and cloud interactions. With LACIS we offer a facility for the investigation of complex phase transition processes such as particle/droplet hygroscopic growth, activation, and ice nucleation. Thermodynamic parameters such as temperature, pressure, relative humidity, critical supersaturation, composition and concentrations of particles/droplets and of chemical composition of the carrier gas can be varied in ranges similar to the atmosphere. **LACIS** is part of the **Transnational Access of Eurochamp-2**.

2. Description of the research facility

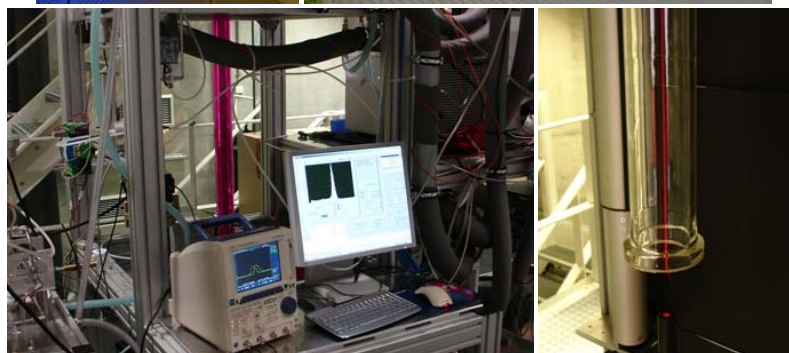
LACIS consists of laminar flow tube with thermostated walls. The length of the flow tube can vary from 0.5 up to 10 m. Residence times up to 60 s and temperatures down to -40 °C are feasible. Using high precision instruments, the thermodynamic conditions in the LACIS flow tube are controlled with extremely high accuracy. LACIS can be used to investigate aerosol/cloud microphysical processes such as aerosol particle/droplet hygroscopic growth, activation, and heterogeneous ice nucleation. To describe the fluid flow, heat/mass transfer and particle/droplet dynamics in LACIS, a detailed process model has been developed. It combines the computational fluid dynamics (CFD) code FLUENT with a microphysical particle/droplet dynamics model, the so-called Fine Particle Model (FPM). This model, together with the extensive expertise in the modelling of particle and droplet dynamics, is available at the facility for the interpretation of experimental results gained with LACIS. Please contact us for more information about the use of our chamber.

2.1. Technical data

The main part of LACIS is a thermostated stainless steel chamber. The high precision temperature control (accuracy in the order of 0.01 - 0.05 K) is realized by using several high precision cryostats.

shape	cylinder
size	diameter: 15mm /height 05 - 10mm
wall material	stainless steel
temperature range	213 K - 313 K
operating pressure	750 - 1000 HPa

2.2. Images



2.3. Publications

A detailed list of publication can be found [here](#).

2.4. Access to the chamber under Eurochamp TA

Access to LACIS is provided through Eurochamp-2 Transnational Access and other collaborations. LACIS offers access to various techniques and instruments for aerosol particle generation (e.g. soot, mineral dust, soluble organic and inorganic substances), physical and chemical modification (e.g. tempering, coating) and physical characterization (e.g. particle size distribution, optical properties, shape, morphology). Besides hosting instrumentation from partners for the investigation of aerosol microphysical processes in LACIS, there are also possibilities for instrument tests and intercalibration.

3. Institution in charge of the laboratory facility

The Leibniz Institute for Tropospheric Research (IfT) was founded in 1991 for the investigation of physical and chemical processes in the polluted troposphere. The institute comprises three different departments, i.e. Physics, Chemistry, and Modelling. The IfT is led by Prof. Dr. Andreas Macke.

The IfT physics department investigates meteorological and physical processes of tropospheric aerosols and clouds in the field and in the laboratory. The scientific results emerging from individual experimental studies are used to develop and validate tropospheric process models. The experimental methods include ground-based or airborne in-situ aerosol and cloud characterizations, radiation measurements, and remote sensing of meteorological data and microphysical aerosol and cloud parameters. LACIS is part of IfT's cloud group (group leader Dr. Frank Stratmann) which comprises field and laboratory investigations concerning cloud microphysical and turbulent processes.

3.1. Contact Information

✉ [Frank Stratmann](mailto:Frank.Stratmann@ift.uni-leipzig.de), phone: +49 341 235 2862, fax: +49 341 235 2461

Institute for Tropospheric Research
Permoserstr. 15
04318 Leipzig, Germany

4. Additional Information

<http://www.tropos.de>



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Chambers LEAK

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LEAK: description and transnational access

1. Introduction

As housing for the new Ift aerosol chamber a hall was completed in spring 2004. In this hall is built the new chamber facility LEAK. The chamber is designed for laboratory investigations of atmospheric processes such as the oxidation of organic compounds and secondary organic aerosol formation. LEAK is part of the Transnational Access of EUROCHAMP-2.

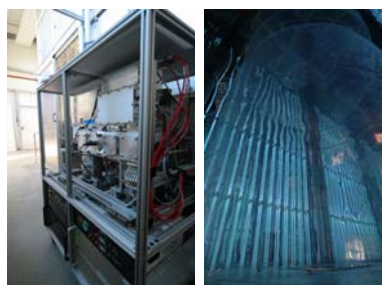
2. Description of the research facility

The simulation chamber LEAK has a cylindrical geometry, a volume of 19 m³ and is made of Teflon FEP film. LEAK is equipped with a humidifier, an ozone and a particle generator. Outlets of the chamber are connected with a condensation particle counter (CPC), a continuous monitoring ozone analyzer and a particle sampling filter device with a fixed integrated annular denuder to avoid gaseous contamination of the deposited particles during sampling. The size distributions of particles in the aerosol chamber as a function of time are measured by a differential mobility particle sizer (DMPS). An Agilent gas chromatograph (GC-MS) and a PTR-MS (Ionicon) monitor gas-phase hydrocarbon concentrations in the chamber. A variety of state-of-the-art instrumentation including NO/NO₂ and ozone monitors and offline instrumentation including HPLC-ESI/ITMS, HPLC-ESI/TOFMS and GC/MS are available.

2.1. Technical data

shape	cylinder
volume	19.0 m ³
surface to volume ratio	2.0 m ⁻¹
lighting	56 fluorescence lamps (Eversun Super), 8 blacklight blue fluorescence lamps
temperature range	16 - 30 °C
operating pressure	750 - 1000 HPa
gas purity	zero air
maximum purge rate	12 m ³ /h
wall material	FEP film

2.2. Images



2.3. Publications

Aerosol-chamber study of the α -pinene/O₃ reaction: influence of particle acidity on aerosol yields and products, Y. Iinuma, O. Böge, T. Gnauk and H. Herrmann, Atmos. Environ. 38, 761-773 (2004)

Laboratory studies on secondary organic aerosol formation from terpenes, Y. Iinuma, O. Böge, Y. Miao, B. Sierau, T. Gnauk and H. Herrmann, Faraday Discuss. 130, 279-294 (2005)

Formation of secondary organic particle phase compounds from isoprene gas-phase oxidation products: An aerosol chamber and field study, O. Böge, Y. Miao, A. Plewka and H. Herrmann, Atmos. Environ. 40, 2501-2509 (2006)

The formation of organic sulfate esters in the limonene ozonolysis secondary organic aerosol (SOA) under acidic conditions, Y. Iinuma, C. Müller, O. Böge, T. Gnauk and H. Herrmann, Atmos. Environ. 41, 5571-5583 (2007)

Application of CE/ESI-MS/MS analysis to structural elucidation of methylenecyclohexane ozonolysis products in the particle phase, C. Müller, Y. Iinuma, O. Böge, H. Herrmann, Electrophoresis, 28, 1364-1370 (2007)

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2.4. Access to the chamber under Eurochamp TA

Access to LEAK is provided through EUROCHAMP-2 Transnational Access and other collaborations. All necessary training and guidance will be provided, from experimental design and procedures to data analysis

3. Institution in charge of the laboratory facility

The Leibniz Institute for Tropospheric Research e.V. (IfT) was founded 1992 for the investigation of physical and chemical processes in the polluted troposphere. Meanwhile, a well-defined and globally unique research profile of IfT emerged, with a focus on aerosols, i.e. small airborne particles, and clouds. The Leibniz Institute for Tropospheric Research conducts field studies in several polluted regions parallel to the development of analytical methods for aerosol and cloud research. These tools are not only applied in field experiments but also in extensive laboratory investigations, which form a second major activity. A third and equally important approach consists of the formulation and application of numerical models that reach from process models to regional simulations of the formation, transformation and effects of tropospheric multiphase systems.

3.1. Contact Information

[Prof. Hartmut Herrmann](#), phone: +49 341 235 2446, fax: +49 341 235 2325

4. Additional Information

n.a.



EUROCHAMP-2

Integration of **E**uropean **S**imulation **C**hambers for
Investigating Atmospheric **P**rocesses

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MASCAPITAS: description and transnational access

1. Introduction

MASCAPITAS (Manchester Atmospheric Simulation Chamber for Aerosol Property, Impact, Transformation & Ageing Studies) has been designed to study atmospheric processes of multicomponent aerosols under controlled conditions. Our research ranges from formation and transformation of secondary organic aerosols (SOA) under seeded and un-seeded conditions to investigations of the direct and indirect effects of multicomponent aerosols on climate. A key feature and major objective of the chamber facility is to investigate the changing potential of the aerosol populations to affect radiative forcing as they evolve chemically and physically and thus to improve quantification of the effects of competing aerosol processes on climate. [MASCAPITAS](#) is part of the [Transnational Access of Eurochamp-2](#).

2. Description of the research facility

The Manchester aerosol chamber is run as a batch reactor where the composition of the gaseous precursors, pre-existing seed, oxidising environment, relative humidity and temperature is controlled. The chamber comprises an 18 m³ (3m(H)x3m(L)x2m(W)) FEP Teflon bag mounted on three rectangular extruded aluminium frames. The central rigid rectangular frame is fixed, with the upper and lower frames free to move vertically causing the bag to expand and collapse as sample air is introduced and extracted, ensuring maintenance of a slight positive pressure throughout each cycle and minimizing contamination from laboratory air. A bank of halogen lamps and a 6 kW Xenon arc lamp are mounted on the enclosure housing the bag which is coated with reflective "space blanket" serving to render the enclosure as an integrating sphere, maximising the irradiance in the bag and ensuring even illumination.

An aerosol generation system and heated gaseous charge injection port allow control of the experimental initial input concentrations of seed aerosol particles and parent VOCs. NO_x levels are controlled by injection from a cylinder into the charge line and a high capacity O₃ generator can control initial O₃ concentrations as well as serving as a cleaning agent during flushing between experiments. RH and T are measured at several points throughout the chamber (by dewpoint hygrometer and a series of thermocouples and resistance probes) and are controlled by diverting air through the inlet humidification circuit and by controlling the air conditioning setpoint. This controls the conditions throughout the experiment.

A wide range of instruments are available for deployment in ground and aircraft-based field measurement within the Centre for Atmospheric Sciences at the University of Manchester. These are available for deployment in the chamber in scheduled campaign mode and otherwise periodically when not in field use. In addition, there are a range of core instruments available for all experiments. Instruments sampling from the centre of the chamber evaluate the size, chemical composition, hygroscopic properties and cloud-forming potential of the aerosol particles as well as gas phase measurements of ozone and nitrogen oxides.

2.1. Technical data

Specific information is found [here](#)

2.2. Images



Inlet system

2.3. Publications

Several papers from the ACES (aerosol coupling in the Earth System) project are currently in preparation.

2.4. Access to the chamber under Eurochamp TA

Access to MASCAPITAS can be provided through Eurochamp-2 Transnational Access as well as other collaborations. Please contact us in order to discuss the appropriate setup for new projects. Access is typically for 1-4 weeks at a time with 6 months notice (possibly less by prior arrangement). Users will collaborate directly with University of Manchester staff working at MASCAPITAS and its instrumentation (Gordon McFiggans, Rami Alfarra and others).

There is provision for modifications of inlet lines on request. Access to workshops and laboratories can be provided after consultation. Chamber data and the data of the installed instruments are available for the user.

Unit of access is defined as one day spent by any group at the Manchester chamber. The full time period is counted from the day of arrival until the day of departure; the eligible period thus includes also the preparatory phase to set up instruments at the

beginning. Required chamber cleaning days in between experiments are included, as the chamber cannot be used for other purposes during the cleaning procedure.

3. Institution in charge of the laboratory facility

The Centre for Atmospheric Science (CAS) studies processes important to climate change and air quality in the troposphere and lower stratosphere - the lowest 20 km of the Earth's atmosphere. It is one of the largest such groups in UK universities, and have extensive collaborative links with leading atmospheric sciences groups world-wide. The centre has a strong experimental programme, with a range of state-of-the-art facilities for field and laboratory measurements. To complement the measurements we run numerical models on a variety of scales using code developed at Manchester as well as national and international standard models. CAS is part of the School of Earth, Atmospheric and Environmental Sciences (SEAES) at the University of Manchester and currently consists of approximately 90 staff and postgraduate students.

▶ [UMAN](#) is ▶ [partner 14](#) in Eurochamp-2.

3.1. Contact Information

✉ [Prof. Gordon McFiggans](#), phone: +44 161 3063954, fax: +44 161 3063951

✉ [Dr. Rami Alfarra](#), phone: +44 161 3063928, fax: +44 161 3063951

School of Earth, Atmospheric & Environmental Sciences
The University of Manchester
Simon building, Oxford Road
Manchester M13 9PL, UK

4. Additional Information

n.a.