

# SPONSORS

# IIR INTERNATIONAL CONFERENCES

## AS - ISHPC11 GOLD SPONSORS



## AS SILVER SPONSORS



## ISHPC11 SILVER SPONSORS

Sources/Sinks alternative to the outside Air for Heat Pump and Air-Conditioning Techniques (Alternative Sources - AS)

Padua, Italy, April 5-6-7, 2011

International Sorption Heat Pump Conference (ISHPC11)

Padua, Italy, April 6-7-8, 2011

IIR Commissions E1 (Air Conditioning) and E2 (Heat pumps, energy recovery)

## UNDER THE PATRONAGE OF



Provincia di Padova



PATROCINIO REGIONE DEL VENETO



Comune di Padova



COLLEGIO DEGLI INGEGNERI DELLA PROVINCIA DI PADOVA



Università degli Studi di Padova



ORDINE DEGLI INGEGNERI DELLA PROVINCIA DI PADOVA



Cultura e Tecnica per Energia Uomo e Ambiente



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ORDINE  
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DI PADOVA

## ORGANIZED BY



Associazione Italiana Condizionamento dell'Aria Riscaldamento Refrigerazione



Institute International du Froid  
International Institute of Refrigeration



Università degli Studi di Padova

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TIME TABLE	APRIL 5 <sup>TH</sup> 2011	APRIL 6 <sup>TH</sup> 2011		APRIL 7 <sup>TH</sup> 2011				APRIL 8 <sup>TH</sup> 2011		
	CROWNE PLAZA	CROWNE PLAZA	VILLA OTTOBONI	VILLA OTTOBONI	CROWNE PLAZA			CROWNE PLAZA		
8,30 am			AS Registration of the participants		ISHPC11 Registration of the participants			ISHPC11 Registration of the participants		
9,00 am			Opening Ceremony		Opening Ceremony					
9,30 am			AS PLENARY SESSION	AS Registration of the participants	ISHPC11 PLENARY SESSION			ISHPC11 PLENARY SESSION		
10,30 am			COFFEE BREAK		COFFEE BREAK					
11,00 am			AS GROUND	AS SIMULTANEOUS H&C	ISHPC11 ABSORPTION	ISHPC11 ADSORPTION	ISHPC11 HEAT PUMPS	ISHPC11 ABSORPTION	ISHPC11 ADSORPTION	ISHPC11 CO-TRIGENERATION
1,00 pm			BUSINESS LUNCH							
2,30 pm	AS-ISHPC11 Registration of the participants	AS-ISHPC11 Registration of the participants	AS PLENARY SESSION	AS HEAT RECOVERY SOLAR	ISHPC11 ABSORPTION	ISHPC11 ADSORPTION	ISHPC11 DESICCANT	ISHPC11 ABSORPTION	ISHPC11 THERMODYNAMIC CYCLES	ISHPC11 SOLAR
3,30 pm			COFFEE BREAK	AS Closing Session	COFFEE BREAK					
4,00 pm			AS GROUND	Transfer by bus to Crowne Plaza	ISHPC11 ABSORPTION	ISHPC11 ADSORPTION	ISHPC11 DESICCANT	ISHPC11 HEAT PUMPS	ISHPC11 THERMODYNAMIC CYCLES	ISHPC11 SOLAR
6,00 pm			AS Closing Session		ISHPC11 Closing Session			ISHPC11 Closing Session		
			Transfer by bus to Crowne Plaza							
7,00 pm	Welcome Party	Transfer by bus from Crowne Plaza to the Concert Auditorium								
7,30 pm		Concert								
9,30 pm		Buffet at Pedrocchi Coffee House								
11,00 pm		Transfer by bus from Pedrocchi Coffee House to Crowne Plaza								

## GENERAL INFORMATION

Padua is a city 40 km west of Venice. Padua is famous for its University founded in 1222. The list of professors and alumni of the University of Padua includes, among others, Galileo Galilei, Nicolaus Copernicus, Gabriele Falloppio, Pietro Bembo, Torquato Tasso. The place of Padua in the history of art is nearly as important as its place in the history of learning. The list of distinguished artists operating in Padua includes, among others, Giotto, Donatello, Andrea Mantegna, Antonio Canova. Padua is also the birth place of the famous architect Andrea Palladio. Padua includes several historical and artistic sites, such as, the Basilica of Saint Anthony, Scrovegni Chapel, Church of Eremitani, Palazzo della Ragione and several Museums and Galleries. In April the temperature in Padua ranges between 12 and 22°C (53 and 72°F).

### Travel and Transportation

 By Plane. The airports nearest to Padua are Venice Marco Polo (40 km from Padua) and Verona Catullo (80 km from Padua); both airports are served by many frequent international flights.

 By Train. Padua station is on the main Milan-Venice railway link, served by numerous international trains. Intercity and Eurostar trains stop at Padua.

 By Car. Padua is on the A4 (Milan-Venice) motorway, which is linked to the European motorway network.

### Conference Site

The **AS Conference** will take place in Padua at the Villa Ottoboni Convention Centre located in Via Padre E. Ramin 1.

The **ISHPC Conference** will take place in Padua at the Crowne Plaza Hotel, Via Po 197.

## GENERAL INFORMATION

### Registration Desk

DATE	TIME TABLE	LOCATION
Tuesday, April 5th	2,30 pm/6,00 pm	Crowne Plaza hotel both AS and ISHPC11
Wednesday, April 6th	8,30 am/6,00 pm	Villa Ottoboni Congress Center - AS
	2,30 pm/6,00 pm	Crowne Plaza hotel both AS and ISHPC11
Thursday, April 7th	8,30 am/3,00 pm	Villa Ottoboni Congress Center - AS
	8,00 am/6,00 pm	Crowne Plaza Hotel - ISHPC11
Friday, April 8th	8,00 am/3,00 pm	Crowne Plaza Hotel - ISHPC11

### Conferences Badges

The appropriate badge is the only pass for all Conferences events a participant is entitled to attend.

Participants are therefore kindly invited to wear their badges during all official Conferences events.

### Shuttle-Bus Service Hotels Conference Site

A courtesy shuttle bus service will be provided from Crowne Plaza and Villa Ottoboni Congress Center:

Wednesday, April 6th	Pick up times, at 8,15 am - back at 6,00 pm
Thursday, April 7th	Pick up times, at 9,15 am and 10,30 am - back at 3,30 pm (every half an hour on demand)

**Concert at Sala dei Giganti**

All registered participants (both Conferences) and registered accompanying persons are warmly invited to join for an evening Classical Music Concert at the Sala dei Giganti, Palazzo Liviano, Piazza dei Signori.

The 'Sala dei Giganti' (Hall of Giants) is in a building that is now part of the University of Padua, but originally was part of the Carraresi Palace. The Hall is decorated by a fresco cycle painted in 1540 depicting illustrious historical figures. The hall is now a venue for concerts, meetings and exhibitions.

**Programme**

BARITONE: GIUSEPPE PIAZZA

PIANO: PATRIZIA QUARTA

**Mozart: from Figaro to Don Giovanni**

Non più andrai (from le Nozze di Figaro)

Aprite un po' quegli occhi (from le Nozze di Figaro)

Deh vieni alla finestra (from Don Giovanni)

Aria dello champagne (from Don Giovanni)

**The 19th century Italian Romance**

Tristezza (Tosti)

L'ultima canzone (Tosti)

Musica proibita (Gastaldon)

Non ti scordar di me (De Curtis)

**The most famous songs from Naples**

Fenesta ca lucive (Anonimo)

I' te vurria vasà (Di Capua)

Torna a Surriento (De Curtis)

Core 'ngrato (Sisca)

Dicintecello vuie (Falvo)

Following the concert a Buffet dinner will be held at 9,00 p.m. at the hystorical **Coffee House Caffé Pedrocchi**, now considered the finest and most beloved coffeehouse in Italy, Café Pedrocchi embodies the Neoclassical style of architecture crafted by the Venetian architect Giuseppe Jappelli and situated near the University and Main Square. It will be an excellent opportunity to meet other attendees and to discuss mutual interests and activities in a beautiful fascinating surrounding.

Buses will pick up participants at the 7,00 pm from the Crowne Plaza Hotel to the Concert Auditorium. Buses will return participants to Crown Plaza Hotel after the buffet dinner.

**Venice and Murano Island tour € 130,00 + 20% VAT**

Departure 9.30 am - end 5.30 pm

The tour will start from the Crowne Plaza Padua by private bus; once arrived in Venice the excursion will begin in St. Mark's square with the visit of its principal monuments: the Palazzo Ducale, the St. Mark's Basilica and the Bridge of Sighs.

After lunch the participants will have two options: to attend the visit of the laguna and Murano Island or to have the afternoon free for shopping or visiting on their own.

At the end of the visit back to the Crowne Plaza Padua by motor boat and private bus.

- The fee includes:
- Private motor boat from Crowne Plaza to Venice and back
- English speaking guide
- Tickets entrance to the monuments
- Private Motor bus
- Lunch in a typical Venetian Restaurant

**Padua tour (free of charges)**

Departure 9.30 am - end 12.30 pm

Registered accompanying persons are invited to join a guided walking tour of the city of Padua.

The meeting point is the hall of Crowne Plaza Hotel.

The tour will start from the Crowne Plaza Padua by taxi. The excursion will begin with the exterior visit of the Santo's Church, the Basilica of St. Anthony, one of the most visited sanctuary of Christianity. Then the group will go through Piazza dei Signori and Piazza delle Erbe, the political and economic sites of Middle Age of Padua. After the exterior visit of the Palazzo della Ragione the group will end the tour with the visit of the Scrovegni Chapel.

At the end back to the hotel by taxi. The participants will have the option to remain in the city center to have the afternoon free for shopping or visiting on their own.

## Sources/Sinks alternative to the outside Air for Heat Pump and Air-Conditioning Techniques (Alternative Sources - AS)

IIR Commissions E1 (Air Conditioning) and E2 (Heat pumps, energy recovery)

### WELCOME TO THE IIR INTERNATIONAL CONFERENCE

Heat sources and heat sinks of heat pumps and refrigeration systems, respectively, have an immense impact on performance. The outside air is the most common heat pump source/sink. However it is thermodynamically the least favourable source since the thermal load is increasing when its level is decreasing so that both heat pump COP and capacity decrease. Symmetrically it is also one of the worst summer sink considering the usually high outside summer air temperature.

Heat pumps and refrigerating machinery are usually very sensitive to the low and high temperatures of the cycle. Therefore turning to alternative sources/sinks with more favourable temperatures can allow appreciable advantages both in terms of efficiency and heating/cooling capacity.

Many are the possible alternative: surface and underground water, ground, heat recovery, solar, sometimes a combination of two or more of the above.

As the first costs of these alternatives are usually higher than for outside air, it is of great moment to produce technical and economical analysis to assess the feasibility of plants or to consider the results of realised plants.

This conference is an opportunity not to be missed as it gathers researchers, scientists and engineers from all over the world sharing their different experiences for all kinds of heat pumping and refrigerating technologies with particular emphasis on ground source and heat recovery heat pumps, considering also the dual source installations.

WEDNESDAY APRIL, 6TH

ALTERNATIVE SOURCES - AS

SALA OTTOBONI

OPENING CEREMONY

9,00 A.M. - 9,30 A.M.

#### Presentation of the AS - ISHPC11 conferences

Renato Lazzarin, *President of the Organizing Committee*

#### Presentation of the Institute International du Froid / International Institute of Refrigeration

Didier Coulomb, *Director of the IIF/IIR*

#### Presentation of the ASHRAE

Eckhard Groll, *Ashrae Ambassador*

Aicarr video

ALTERNATIVE SOURCES - AS

SALA OTTOBONI

PLENARY SESSION

9,30 A.M.-10,30 A.M.

Chairman: Alberto Cavallini

#### Ground source systems: state of the art and prospects

Sanner Burkhard, *President of the European Geothermal Energy Council (EGEC), Giessen, Germany*

#### Dual source heat pump systems: operation and performance

Renato Lazzarin, *DTG, Department of Management and Engineering, University of Padua, Italy*

COFFEE BREAK

WEDNESDAY APRIL, 6TH

ALTERNATIVE SOURCES - AS

SALA OTTOBONI

AS - GROUND

11,00 A.M. -1,00 P.M.  
Chairman: Herman Halozan

**Experiences with two coaxial borehole heat exchanger prototypes**

J. Acuña, B. Palm

**Ground-source heat pumps. overcoming market and technical barriers**

Hermann Halozan

**Energetic and economic comparison between a compression and an absorption ground source heat pump**

Costanzo Di Perna, Guglielmo Magri, Sacha Procaccini

**Use of underground water tank as heat sink**

Roshini Rebecca Easow

**Energy efficiency of variable capacity ground source heat pumps**

Paolo Munari, Enrico Da Riva, Davide Del Col, Mauro Mantovan

**Ground source heat pumps for heating and cooling in the mediterranean countries**

Dimitrios Mendrinou, Jose Miguel Corberan, Enrico Da Riva, Davide Del Col, Carla Montagud

**BUSINESS LUNCH**

WEDNESDAY APRIL, 6TH

ALTERNATIVE SOURCES - AS

SALA OTTOBONI

PLENARY SESSION

2,30 P.M.-3,30 P.M.  
Chairman: Renato Lazzarin

**The heat pump market: present and future**

Monica Axell, *Manager of IEA Heat Pump Centre, Boras, Sweden*

**Heat pumps for simultaneous heating and cooling**

Michael Monsberger, *AIT Austrian Institute of Technology, Wien, Austria*

**COFFEE BREAK**

AS - GROUND

4,00 P.M. - 6,00 P.M.  
Chairman: Burkhard Sanner

**Energy optimization of a ground source heat pump system for heating and cooling in an office building**

J.M. Corberan, C. Montagud, F. Heselhaus

**GSHP application in zones with anomalous gradient of temperature**

Michele De Carli, Giuseppe Emmi, Angelo Zarrella, Antonio Galgaro

**Comparison of borehole heat exchangers response based on different hourly load models**

Marco Fossa, Fabio Minchio

**Numerical evaluation of the thermal resistance for ground coupled heat pump applications**

Marco Fossa, Danila Dalla Pietà

**CLOSING SESSION AS**

Transfer by bus to Crowne Plaza

THURSDAY APRIL 7TH

ALTERNATIVE SOURCES - AS

SALA OTTOBONI

AS - SIMULTANEOUS H&C

11,00 A.M. - 1,00 P.M.  
Chairman: Per Lundqvist

**Versatility and energy efficiency of reversible heat pumps illustrated with case studies**  
Matteo Serraino, Claudio Carano

**Energy analysis of a combined heating and cooling system for conditioning hotels in different climates**  
M. De Carli, F. Cappon, L. Prendin, A. Teti

**A survey on heating and cooling performances of heat pumps present in the Italian market**  
Michele De Carli, Giuseppe Emmi, Antonio Polito, Massimiliano Scarpa

**Units for 4-pipes systems for simultaneous production of heating and cooling energy, designed for dual source applications**  
Luigi De Rossi, Elena Busnardo

**Integrated control system with DC inverter technology for heat pumps**  
Willy Muvegi, Biagio Lamanna

BUSINESS LUNCH

AS - HEAT RECOVERY

2,30 P.M. - 3,00 P.M.  
Chairman: Roberto Zecchin

**An "Active" recovery system for air handling units**  
R. Giannoni, D. Pedrini, M. Parenti, G. Parenti, D. Facchini

**Multisource heat pump: data analysis for the first year of operations**  
Filippo Busato, Renato Lazzarin, Marco Noro

THURSDAY APRIL 7TH

ALTERNATIVE SOURCES - AS

SALA OTTOBONI

AS - SOLAR

3,00 P.M. - 3,30 P.M.  
Chairman: Renato Lazzarin

**Simulated performance of a solar assisted heat pump using ice slurry as a latent storage material**  
Justin Tamasauskas, Michel Poirier, Radu Zmeureanu, Roberto Sunyé

**Performances simulation of an evaporative air cooler using solar energy under algerian climate**  
M.L. Yousfi, S. Elmetenani, Z. Belgroun, L. Merabeti, A. Chikouche

CLOSING SESSION AS

Transfer by bus to Crowne Plaza



## International Sorption Heat Pump Conference (ISHPC11)

IIR Commissions E1 (Air Conditioning) and E2 (Heat pumps, energy recovery)

### WELCOME TO THE IIR INTERNATIONAL CONFERENCE

The International Sorption Heat Pump Conference (ISHPC) is a triennial conference which provides a forum for presenting the research and dissemination activities in Sorption Heat Pumps Technology. For the first time this conference is hosted in Italy, coming back to Europe after the previous edition first in Paris and lately in Munich (1999). In the last 12 years it visited Shanghai (2002), Denver (2005) and Seoul (2008).

This Conference promotes the exchange of ideas and experiences amongst the researchers, scientists and engineers working on Sorption Heat Pumps Technology from all over the world.

The term sorption includes fundamentals and applications of absorption and adsorption. These phenomena allow to realise various types of systems and machinery from the traditional ad/absorption machines to the open cycle systems operating with liquid or solid desiccants.

Solar and heat recovery cooling systems are really relevant applications of principles and technologies this Conference deals with.

Therefore these Proceedings that gather the contributions of researchers, scientists and engineers from all over the world are the milestones for the next three years for whoever wants to operate in this field.

THURSDAY APRIL 7TH

ISHPC11

MIRÒ ROOM

OPENING CEREMONY

9,00 A.M. - 9,30 A.M.

#### Presentation of the ISHPC11 conference

Renato Lazzarin, Giovanni A. Longo, *Co-Chairmen of the Organizing Committee of the ISHPC11 conference*

#### Presentation of the ASHRAE

Eckhard Groll, *Ashrae Ambassador*

Aicarr video

### PLENARY SESSION ISHPC11

MIRÒ ROOM

9,30 A.M.-10,30 A.M.

**Chairman: Carlos A. Infante Ferreira**

#### Open cycle absorption and desiccant technology

Gershon Grossman, *Faculty of Mechanical Engineering, Technion - Israel Institute of Technology, Israel*

#### Trend in absorption machines

Reinhard Radermacher, *Center for Environmental Energy Engineering (CEEE) Mechanical Engineering, A. James Clark School of Engineering, University of Maryland, Energy Research Center, US*

**COFFEE BREAK**

## TECHNICAL SESSION ISHPC11 - ABSORPTION

MIRÒ 1 ROOM

11,00 A.M.-1,00 P.M.

Chairman: Michele De Carli

**A lithium bromide absorption chiller with cold storage**

Ching-Jen Tang, William Gerstler

**Simulation of absorption of H<sub>2</sub>O in falling film of LiBr aqueous in vertical tubes in wavy regime**

E. Garcia-Rivera, J. Castro, J. Farnos, A. Oliva

**Air source gas absorption heat pump cycle with full heating output at low outdoor ambient and high delivery temperatures**

Marco Guerra

**Application of absorption chillers on vessels**

Mathias Safarik, Lutz Richter, Gregor Weidner, Yves Wild, Peter Albring

**Direct air-cooled single effect LiBr/H<sub>2</sub>O absorption prototype using a flat-fan sheets adiabatic absorber; experimental results**

M. Izquierdo, A. González-Gil, J.D. Marcos, M.E. Palacios

**Ionic liquids: new high-performance working fluids for absorption chillers and heat pumps**

M.C. Schneider, R. Schneider, O. Zehnacker, O. Buchin, F. Cudok, A. Kuhn, T. Meyer, F. Ziegler, M. Seiler

**Applications of absorption chillers**

Francesco Barberis

BUSINESS LUNCH

## TECHNICAL SESSION ISHPC11 - ABSORPTION

MIRÒ 1 ROOM

2,30 P.M.-3,30 P.M.

Chairman: Christian Schweigler

**Development of a small capacity air-cooled ammonia/lithium nitrate absorption chiller - first cooling capacity and COP measurements**

M. Zamora, M. Bourouis, M. Vallés, A. Coronas

**Experimental investigation of Ionic liquid emim SO<sub>4</sub> as solvent in a single-effect cycle with adiabatic absorption and desorption**

Michael Radspieler, Christian Schweigler

**Air-cooled, single effect, waste heat-driven water/LiBr absorption system for high ambient temperatures**

K. Gluesenkamp, C. Horvath, R. Radermacher, Y. Hwang

COFFEE BREAK

MIRÒ 1 ROOM

4,00 P.M. - 6,00 P.M.

Chairman: Srinivas Garimella

**Crystallization inhibitors for water/LiBr absorption chillers**

K. Gluesenkamp, R. Radermacher, Y. Hwang

**Thermal conductivity of ammonia-lithium nitrate**

Y. Cuenca, A.Vernet, M.Vallès

**Performance comparison of a bubble absorber with ammonia/lithium nitrate and ammonia (lithium nitrate+water) for absorption chillers**

Cesar Oronel, Carlos Amaris, Manel Vallès, Mahmoud Bourouis, Alberto Coronas

**A modular thermal hub for building integrate energy systems**

Matthew D. Determan, Srinivas Garimella

**Coupled component and system-level simulation of a diffusion absorption refrigeration system for ambient fresh water harvesting**

Alexander S. Rattner, Srinivas Garimella

**Numerical study of heat and mass transfer in lithium bromide-water falling films and droplets**

Vishwanath Subramaniam, Srinivas Garimella

**Experimental study of a spray adiabatic absorber using fog-jet nozzles**

R. Ventas, A. Lecuona, C. Vereda, M. Venegas, M.C. Rodriguez

CLOSING SESSION ISHPC11

## TECHNICAL SESSION ISHPC11 - ADSORPTION

MIRÒ 2 ROOM

11,00 A.M.-1,00 P.M.

Chairman: Robert E. Critoph

**Nitrogen sorption on a activated carbon**

N. Tzabar, G. Grossman

**Study on an adsorption chiller employing lithium chloride in silica gel and methanol: design and experimental study**

L. X. Gong, R. Z. Wang, Z. Z. Xia, Z.S. Lu

**Study on the thermochemical resorption refrigeration and its application in the long-distance cold transportation**

H. S. Bao, R. Z. Wang, T. X. Li

**Influence of temperature fluctuations on the operational behaviour of adsorption chillers**

Matthias Schick Tanz

**Optimal cyclic operation of two-bed adsorption chillers with mass recovery**

Manuel Gräber, Christian Kirches, Johannes Schlöder, Wilhelm Tegethoff

**Experimental setup for determining ammonia-salt adsorption and desorption behavior under typical heat pump conditions: a description of the setup and experimental results**

Michel van der Pal, Robert de Boera, Jakobert Veldhuis, Simon Smeding

**Modeling of a hybrid adsorption-compression heat pump based on a roots compressor and silica gel-water sorption cycle**

Michel van der Pal, Anton Wemmers, Simon Smeding, Jakobert Veldhuis

**Performance analysis and entropy generation for multi-beds adsorption cooling system**

Aung Myat, Kyaw Thu, Kim Choon Ng

BUSINESS LUNCH

## TECHNICAL SESSION ISHPC11 - ADSORPTION

MIRÒ 2 ROOM

2,30 P.M.-3,30 P.M.

Chairman: Claudio Zilio

**Discussion on the use of dimensionless parameters in design of adsorbent beds**

Gamze Gediz Ilis S, Moghtada Mobedi, Semra Ülku

**The potential of PCPs/MOFs for the use in adsorption heat pump processes**

S.K. Henninger, F. Jeremias, J. Ehrenmann, C. Janiak

**Development of a 2D-3D simulation tool for design improvement of adsorbers dedicated to solar air-conditioning systems**

F. Makni, M. Clause, F. Meunier

**A Study on thermophysical characteristics of activated carbon powder/ethanol pair in adsorber**

N. Makimoto, B. Hu, S. Koyama

COFFEE BREAK

MIRÒ 2 ROOM

4,00 P.M.- 6,00 P.M.

Chairman: Ursula Wittstadt

**Stability of adsorption materials under hydrothermal treatment**

G. M. Munz, S. K. Henninger, M. Baumgartner, P. Schossig, H.-M. Henning

**Annular-finned sorption bed heat exchanger design for adsorption heat pump optimization**

A. Raymond, S. Garimella

**Alternative cycle time control methods for variable-temperature-source adsorption heat pumps**

T. R. Robbins, S. Garimella

**Development of new hybrid materials based on zeolite SAPO and carbon supports for adsorption heat pump applications**

L. Bonaccorsi, L. Calabrese, D. Di Pietro, E. Proverbio, A. Freni, G. Restuccia

**Experimental test of plate evaporator for sorption refrigeration systems**

Clause Marc, Leprieur Julien, Meunier Francis

**Refrigeration performance analysis of a consolidated composite of activated carbon with a matrix of sulphuric acid treated expanded graphite**

L.W. Wang, S.J. Metcalf, R.E. Critoph, Z. Tamainot-Telto, R. Thorpe

**Towards tailored materials for adsorption heat pump applications**

Franz Lanzerath, Birger Klitzing, André Bardow

CLOSING SESSION ISHPC11

## TECHNICAL SESSION ISHPC11- HEAT PUMPS

KANDINSKY ROOM

11,00 A.M.- 1,00 P.M.

Chairman: Reinhard Radermacher

**Measuring data and reporting experiences from Holland: two real cases of applications of absorption heat pumps**

Ronald Schilt

**Optimal performance of compression resorption heat pump systems**

D.M. van de Bor, C.A. Infante Ferreira

**Integrated approach for the treatment of steady-state operational data of absorption chillers and heat pumps**

David Martínez-Maradiaga, Dereje Sendeku, Joan Carles Bruno, Alberto Coronas

**Performance analysis of absorption heat pumps using conventional working fluids and alternatives**

Dragos Hera, Catalina Vasilescu

**Thermodynamic analysis of ionic liquids as absorbent for absorption Heat Pumping processes**

O. Kotenko, H. Moser, R. Rieberer

**Optimal schematic diagram of a double-effect parallel-flow H<sub>2</sub>O-LiBr absorption heat pump**

Luca Molinaroli, Cesare Maria Joppolo, Stefano De Antonellis

**Expanded graphite mixture for packed bed reactor of chemical heat pump**

Seon Tae Kim, Junichi Ryu, Yukitaka Kato

BUSINESS LUNCH

## TECHNICAL SESSION ISHPC11 - DESICCANT

KANDINSKY ROOM

2,30 P.M.- 3,30 P.M.

Chairman: Gershon Grossmann

**Experimental study on a silica gel coated heat exchanger**

T.S. Ge, Y.J. Dai, Y. Zhao, R.Z. Wang

**Development of a novel desiccant chiller with regenerative evaporative cooling**

Y.J. Dai, D.La, H.Li, R.Z. Wang

**Limiting heat and mass transfer mechanisms in desiccant wheels**

M. Goldsworthy, S. D. White

**Simulation of heat driven air conditioning systems integrating desiccant wheels and absorption chillers**

Stefano De Antonellis, Cesare Maria Joppolo, Luca Molinaroli

COFFEE BREAK

KANDINSKY ROOM

4,00 P.M.- 6,00 P.M.

Chairman: Khaled Gommed

**Cycle simulation of hybrid desiccant cooling system utilizing solar energy**

Siyoung Jeong, Dae Hwan Kim, Young Lyoul Kim, Seon Chang Kim

**Performance of four-divided adsorbent rotor for desiccant dehumidification**

A. Kodama, A. Sanno, Y. Osaka

**Potential study of desiccant wheel-based water catchment from air and possible applications for climatization**

Christian Glück, Emilio Roldán Blasco, Bernhard Lenz, Ferdinand P. Schmidt

**Experimental performance of a liquid desiccant dehumidification system using an indirect contact Heat & mass exchanger**

Rajat Subhra Das, Sagun Tripathi, Sanjeev Jain

**Experimental analysis on the performances of a desiccant wheel regenerated by low grade thermal Energy**

Giovanni Angrisani, Francesco Minichiello, Carlo Roselli, Maurizio Sasso

**Experimental analysis of a desiccant based air conditioning system for a flower Hothouse**

Giovanni A. Longo, Andrea Gasparella

CLOSING SESSION ISHPC11

## PLENARY SESSION ISHPC11

MIRÒ ROOM

9,30 A.M.-10,30 A.M.

Chairman: Reinhard Radermacher

**Advancement in solar cooling**Carlos Infante Ferreira, *DELFT University of Technology, The Netherland***Enhancement techniques in absorption heat and mass transfer**Shigeru Koyama, *Heat & Mass Transport Processes laboratory, Dep. Of Energy and material Sciences, Faculty of Engineering Sciences- Kyushu University, Japan*

COFFEE BREAK

## TECHNICAL SESSION ISHPC11 - ABSORPTION

MIRÒ 1 ROOM

11,00 A.M.-1,00 P.M.

Chairman: Shigeru Koyama

**Nucleate pool boiling heat transfer of 2-Ethly-1-Hexanol Add-ED LiBr solution on a nano-porous surface**

Chi Young Lee, Bong June Zhang, Jiyeon Park, Kwang J. Kim , Barry Belmont

**Study on the performances of an ejector as adiabatic absorber in absorption cycles**

Ciro Vereda, Rubén Ventas, Antonio Lecuona, María Venegas

**On-line concentration measurement of ammonia aqueous solution**

Siyong Jeong, Han Gu Yoon, Dae Hwan Kim, Seong- Ryong Park, Minsung Kim

**The effects of oil-droplet concentration and surfactant on bubble absorption performance enhancement in binary nanoemulsions**

Young-Jin Kim, Jin Ki Lee, Yong Tae Kang

**CO<sub>2</sub> absorption enhancement by using methanol based Al<sub>2</sub>O<sub>3</sub> nanofluids**

Israel Torres Pineda, Jung-Yeul Jung, Jae Won Lee, Yong Tae Kang

**Parametric analysis aimed at optimizing the control logic of an absorption-based cooling system**

G. Evola, L. Marletta, N. Le Pierrès, E. Wurtz

**Study state simulation of absorption type heat pump: fundamental models considering heat and mass transfer in detail**

Daisuke Wada, Keisuke Ohno, Kiyoshi Saito

BUSINESS LUNCH

## TECHNICAL SESSION ISHPC11 - ABSORPTION

MIRÒ 1 ROOM

2,30 P.M.- 3,30 P.M.

Chairman: Alberto Coronas

**Research on LiBr-H<sub>2</sub>O absorption refrigeration system with integrated storage under crystallization conditions**

Qichao Yang, Xiaoling Zhang, Wenxing Shi, Yinping Zhang

**Static simulation of double- stage absorption heat transformer with modular analysis**

H. Tano, K. Saito, N. Inoue

**Absorption gas fired chiller: recovery heat for heating in winter**

Antonio Polito, Giuseppe Emmi, Michele De Carli

COFFEE BREAK

## TECHNICAL SESSION - ISHPC11 HEAT PUMPS

MIRÒ 1 ROOM

4,00 P.M.- 6,00 P.M.

Chairman: Alberto Cavallini

**Heat transfer calculation for absorption heat pumps under variable flow rate conditions**

Jan Albers, Felix Ziegler

**Gas absorption heat pump performance measurement: comparative analysis of norms, discrepancies, implications and possible amendments**

Elisabetta Ainardi, Luigi Tishcher

**The reactivity of metal salt-modified materials for chemical Heat Pump in a repetitive reaction**

H. Ishitobi, K. Uruma, J. Ryu, Y. Kato

**The Italian absorption appliance market**

Paolo Colaiemma

**Progress in the development of a carbon-ammonia adsorption gas-fired domestic heat pump**

R.E. Critoph , S.J. Metcalf

CLOSING SESSION ISHPC11

## TECHNICAL SESSION ISHPC11 - ADSORPTION

MIRÒ 2 ROOM

11,00 A.M.-1,00 P.M.

Chairman: Claudio Zilio

**Unified water adsorption measurement procedure for sorption materials**

S.K. Henninger, A. Freni, L. Schnabel, P. Schossig, G. Restuccia

**Simulation of water sorption dynamics in adsorption chillers**

A. Freni, Yu. I. Aristov, G. Maggio, A.S. Glaznev, F. Cipiti

**Numerical Layer optimization of aluminum fibre/sapo-34 composites for the application in adsorptive heat exchangers**

G. Földner, L. Schnabel, U. Wittstadt, H.-M. Henning, F.P. Schmidt

**Evaluation of different evaporator concepts for thermally driven sorption Heat pumps and chiller**

Lena Schnabel, Kai Thomas Witte, Jacek Kowol, Peter Schossig

**Modelling of a waste heat driven silica gel/water adsorption cooling system. Comparison with experimental results**

M. Verde, J.M. Corberan, R. de Boer, S. Smeding

**Improvement in water vapor sorption on inorganic salt-supported anodic alumina plate**

M. Kumita, K. Watanabe, H. Komori, Y. Suwa, A. Kodama

**Dynamic characteristics of a chemical heat pump consisting of calcium chloride/expanded graphite composites**

Keiko Fujioka, Hiroshi Suzuki, Naonobu Miyatani, Taketo Fudaba

**Adsorption heat exchangers - a comparison of two experimental methods for their characterisation**

Ursula Wittstadt, Alessio Sapienza, Daniel Sonnekalb, Andrea Frazzica, Giovanni Restuccia, Lena Schnabel

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## TECHNICAL SESSION ISHPC11 - THERMODYNAMIC CYCLES

MIRÒ 2 ROOM

2,30 P.M.- 3,30 P.M.

Chairman: Filippo Busato

**Organic rankine cycle with solution circuit for ultra low grade waste heat recovery**

A. Krishna, E.A. Groll, S. V. Garimella

**Investigation of an improved solar-powered open absorption system for cooling, dehumidification and air conditionings**

Khaled Gommed, Gershon Grossman

**Heat exchange analysis of coabsorbent cycle absorption processes**

Mihail-Dan Staicovici

**Use analysis of water-lithium bromide multi-effect pressure-stage coabsorbent cycle in air conditioning**

Mihail-Dan Staicovici

COFFEE BREAK

MIRÒ 2 ROOM

4,00 P.M.- 6,00 P.M.

Chairman: Srinivas Garimella

**Waste heat driven absorption/vapor compression cascade refrigeration system for megawatt scale, high-flux, low temperature cooling**

Srinivas Garimella, Ashlie M. Brown, Ananda Krishna Nagavarapu

**Second law analysis of a novel cycle concept for adsorption heat pumps**

Valentin Schwamberger, Chirag Joshi, Ferdinand P. Schmidt

**Performance optimization of an adsorption chiller: cycle time and duration of isobaric phases**

A. Sapienza, S. Santamaria, I.S. Glaznev, G. Cacciola, Yu.I. Aristov

CLOSING SESSION ISHPC11

FRIDAY APRIL 8TH

## TECHNICAL SESSION ISHPC11 CO - TRIGENERATION

KANDINSKY ROOM

11,00 A.M.-1,00 P.M.

Chairman: Renato Lazzarin

**Optimized control strategy of a combined heating, cooling and power system**

Matthias Schick Tanz, Nan Kishore Kumuda Rajgopal, Hannah Neumann, Tomás Núñez

**Modeling, simulation and assessment of a small scale sorption cooling system driven by a micro cogeneration unit in a residential building**

M. Kegel, R. Sunye, N. Galanis, M. A. Douglas

**Design and construction of a low regeneration temperature zeolite-based adsorption heat pump for ICE-based residential trigeneration**

K. Gluesenkamp, R. Radermacher, Y. Hwang

**Energetic and economic analysis of trigeneration for San Nicola Building**

Filippo Busato, Renato Lazzarin, Marco Noro

**Performance evaluation of a CCHP system with thermal storage in buildings of different load characteristics**

Xiaoling Zhang, Qichao Yang, Wei Wu, Wenxing Shi, Xianting Li

**Performance analysis for the characteristics of CHP system (micro gas turbine + hybrid type absorption chiller)**

E. J. Pialago, XiRu Zheng, Da Young You, Ick Tae Im, Chan Woo Park

BUSINESS LUNCH

FRIDAY APRIL 8TH

## TECHNICAL SESSION ISHPC11 - SOLAR

KANDINSKY ROOM

2,30 P.M. - 3,30 P.M.

Chairman: Carlos A. Infante Ferreira

**Simulation and optimization of a solar-powered adsorption ice-maker**

C. Li, R.Z. Wang, L.W. Wang, T.X. Li

**Performance and techno-economic viability of a water/LiBr absorption heat Transformer driven by solar energy for heating applications**

J. Pascual, J. López-Villada, J. C. Bruno, A. Coronas

**Assessment of perspectives of solar cooling technologies**

Mathias Safarik, Christian Schweigler, Edo Wiemken

COFFEE BREAK

KANDINSKY ROOM

4,00 P.M. - 6,00 P.M.

Chairman: Renato Lazzarin

**Solar driven multi-effect sub-zero ammonia based sorption cycles**

Catalina Vasilescu, Carlos Infante Ferreira

**Water-ammonia absorption cycles for solar cooling and heating applications**

Giuseppe Corallo

**Daily solar cold production of single effect absorption chiller at optimum operating conditions**

A. Lecuona, J. I. Nogueira, R. Ventas, C. Vereda

**A multi-level model predicting a solar adsorption system operation**

G. Santori, A. Freni, G. Restuccia, F. Polonara

**Solar-assisted cooling and heating with a multi-stage absorption chiller**

Riepl Manuel, Gurnter Richard, Schweigler Christian

CLOSING SESSION ISHPC11