

101hIIRCONFIGUEDONCEIDTBCOOLING andApplicationsOfCeloTBMaterials August 21-24, 2024, Baotou, China

# Proprame

**Hosted by** International Institute of Refrigeration (IIR)

### **Organized by**

Chinese Association of Refrigeration (CAR) University of Ljubljana Key Laboratory of Cryogenics, TIPC, CAS Baogang Group Baotou Research Institute of Rare Earths China Northern Rare Earth (Group) High-Tech Co., Ltd. Inner Mongolia Association of Refrigeration (IMAR) State Key Laboratory of Baiyunobo Rare Earth Resource Researches and Comprehensive Utilization Baotou Jinmeng Magnetic Materials Co., Ltd.

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# Welcome Message

Dear Delegates,

Our warmest welcome to the 10th IIR Conference on Caloric Cooling and Applications of Caloric Materials in Baotou!

On behalf of the Organizing Committee and Programme Committee of 10th IIR Conference on Caloric Cooling and Applications of Caloric Materials, it is for us a great pleasure and honor to invite you to attend the 10th THERMAG conference, which will be held from August 21 to August 24, 2024 in Baotou, China, one of the world largest city in rare-earth materials and manufacture zone. The conference will be held at Shangri-La Baotou, China.

Come and experience a diverse range of solid-state cooling materials and engineering related topics that are the foundation of the conference, ranging from various caloric material properties to diverse prototypes, and potential applications. Seize the opportunity to meet colleagues, scientists and engineers from research and industry, to share ideas and experiences and to develop collaborations in Baotou, China. The technical programme will feature the latest research and state-of-the-art developments in all areas of solid-state cooling, heating and power generation, including magneto-, elasto-, baro- and electro-caloric effects to novel thermal engineering techniques and prototype designs, as well as practical applications.

Baotou, nestled in the heart of Inner Mongolia, captivates with its unique blend of natural wonders and cultural heritage. The city boasts the breathtaking scenery of the vast Gobi Desert, juxtaposed against the serene Maoer Temple, a testament to centuries-old Buddhist traditions. Its steel industry stands as a modern marvel, showcasing the city's industrial prowess amidst rolling hills. Add to that, the delectable Mongolian cuisine and the vibrant ethnic festivals, Baotou invites travelers to embark on a journey that intertwines history, nature, and modernity. Baotou plays a key role in the economic expansion of Inner Mongolia and the implementation of China's Belt and Road Initiative, which involves the revival of the ancient overland and marine Silk Road routes.

We look forward to seeing you in Baotou!

Prof. Qingguo MENG	Prof. Ercang LUO
The Organizing Committee Chair	The Conference Chair

# **General Information**

#### Language

The official language for the conference is English. All papers and presentations should be prepared in English.

#### **Electricity**

Electricity is supplied at 220V, 50Hz AC throughout China.

#### **Internet access**

Wireless Internet access is available to the conference attendees in Shangri-La Baotou.

#### **Currency and Banking**

The official name for the currency of China is the Renminbi (RMB). It is denominated into the Yuan. Foreign currency can be exchanged for RMB at airports, banks and hotels. Major credit cards are accepted at most hotels.

#### Speaker Guide

Oral presenters are required to copy their presentation to the computer 10 minutes before the scheduled session. Authors must assure that all fonts needed are embedded in their presentation files, which are compatible with Microsoft Office 2010. To avoid disruption of the session, the author will not be allowed to use their own computer and files will need to be downloaded to the computer from a USB key.

#### Liability

The conference secretariat and organizers cannot accept liability for personal accidents, loss of or damage to private property of participants, students and accompanying persons, either during, or directly arising from Thermag 2024. Participants should make their own arrangements with respect to health and travel insurance.

# **Committees**

#### **Conference Chair**

Prof. Ercang LUO, CAR Vice President, Technical Institute of Physics and Chemistry, CAS

#### **Organizing Committee**

Chair Prof. Qingguo MENG, CAR Executive Vice President

#### Co-Chair

Mr. Zhengang LIU, Deputy General Manager, Baogang Group Mr. Mi YAN, President of Baotou Research Institute of Rare Earths

#### Member

Mr. Didier COULOMB, IIR Director General
Porf. Xianting LI, IIR Commission E1President, Tsinghua University
Prof. Andrej KITANOVSKI, University of Ljubljana
Prof. Reinhard RADERMACHER, University of Maryland
Prof. Xiaohu LI, CAR Vice President and Secretary General
Mr. Jie DING, CAR Vice President, Dalian Bingshan Group
Mr. Qiang WANG, CAR Vice President, Moon Environment Technology
Prof. Xudong TIAN, CAR Vice President, Hefei General Machinery Research Institute
Prof. Changyong LIU, CAR Vice President
Prof. Kexue WEN, CAR Vice President, China Railway Special Cargo Logistics
Prof. Wei XU, CAR Vice President, China Academy of Building Research
Prof. Hong XU, CAR Vice President, Gree Electric Appliance Research Institute
Prof. Jianming TAN, CAR Vice President, Gree Electric Appliances, Inc. of Zhuhai
Mr. Zhihua ZHAO, Chief Engineer of China Northern Rare Earth (Group) High-Tech Co., Ltd.
Mr. Zhiqiang LI, Standing Vice-President of Baotou Research Institute of Rare Earths

#### **Secretary General**

Prof. Huaqian JING, CAR Deputy Secretary-General

#### **Programme Committee**

Prof. Wei DAI, Technical Institute of Physics and Chemistry Prof. Fengxia HU, Institute of Physics Prof. Jiaohong HUANG, Baotou Research Institute of Rare Earths Prof. Huilong HOU, Beihang University Prof. Tao JIN, Zhejiang University Prof. Xianting LI, IIR Commission E1 President, Tsinghua University Prof. Suxi QIAN, Xi'an Jiaotong University Prof. Xiaoshi QIAN, Shanghai Jiaotong University Prof. Limin QIU, Zhejiang University Prof. Jun SHEN, Beijing University of Sciences and Technology Prof. Peijue SUN, Institute of Physics Prof. Yan WANG. Baotou Research Institute of Rare Earths Prof. Jianghong WU, Huanan University of Sciences and Technology Dr. Jingyuan XU, Karlsruhe Institute of Technology Prof. Peng ZHANG, IIR Section A2 President, Shanghai Jiaotong University Dr. Biao ZHONG, Technical Institute of Physics and Chemistry, CAS Associate Prof. Min ZHOU, Technical Institute of Physics and Chemistry

#### **Scientific Committee**

Prof. Jader BARBOSA, Federal University of Santa Catarina Prof. Luana Caron, Bielefeld University Prof. Alberto CORONAS, IIR Commission E2 President, Rovira i Virgili University Prof. Wei DAI, Technical Institute of Physics and Chemistry Prof. Oliver GUTFLEISCH, Technische Universitat, Darmstadt Prof. Huilong HOU, Beihang University Prof. Fengxia HU, Institute of Physics Prof. Jiaohong HUANG, Baotou Research Institute of Rare Earths Prof. Ji Hwan JEONG, IIR Commission B2 President, Pusan National University Prof. Tao JIN, Zhejiang University Prof. Andrej KITANOVSKI, University of Ljubljana Prof. Xianting LI, IIR Commission E1President, Tsinghua University Prof. Xavier MOYA, University of Cambridge Prof. Antoni PLANES, University of Barcelona Prof. Suxi QIAN, Xi'an Jiaotong University Prof. Xiaoshi QIAN, Shanghai Jiaotong University Prof. Limin QIU, Zhejiang University Prof. Julie STAUNTON, University of Warwick Dr. Jingyuan XU, Karlsruhe Institute of Technology Prof. Peng ZHANG, IIR Section A2 President, Shanghai Jiaotong University Prof. Qiming ZHANG, Pennsylvania State University

# Registration

All prospective participants are encouraged to register on-line (http://thermag-x.car. org.cn) at your earliest convenience. All accepted Papers are required to be presented by at least one registered author on the THERMAG 2024 during August 21–24, 2024. Conference Registrations cannot be acknowledged or processed without payment.

On-line Registration		
Early (by July 1, 2024)	Standard (by August 1, 2024)	On-site Registration
720€	760€	800€
500 €	540 €	580€
360€	380€	400€
180€	190€	200€
	On-line R Early (by July 1, 2024) 720 € 500 € 360 € 180 €	On-line RegistrationEarly (by July 1, 2024)Standard (by August 1, 2024)720 €760 € $500 €$ $540 €$ $360 €$ $380 €$ $180 €$ $190 €$

\* The registration fees include coffee breaks, lunches, conference dinner.

\* Accompanying fees include lunches, conference dinner.

# **Venue & Accommodation**

#### Shangri-La Baotou

Shangri - la Hotel, Baotou located in the heart of the city, overlooks the 100,000 -square-metre galaxy plaza and is ideal for business and leisure guests. The hotel is close to the main business district and shopping center, only 15 minutes from the railway station and 30 minutes from the airport.

### Address: 66 Min Zu East Road, Qing Shan District, Baotou, Inner Mongolia, China Tel: (86 472) 599 8888

Reservation Link: http://thermag-x. car.org.cn

#### Transportation

Only 15 minutes' drive to Baotou Station Only 30 minutes' drive to Baotou East Station Only 30 minutes' drive to Baotou Donghe Airport





**1st Floor** 



#### 2nd Floor



# **Plenary Speakers**



#### Prof. Dr. Andrej Kitanovski

University of Ljubljana, Faculty of Mechanical Engineering Slovenia **Title:** Solid-State Energy Conversion: Applications and Perspectives

Prof. Kitanovski heads the Laboratory of Refrigeration and District Energy at the Faculty of Mechanical Engineering in Ljubljana. His main research expertize concerns solid-state cooling and heat pump technologies. He is the founder and chair of the international IIR working group on Solid State Cooling, Heating, which includes energy harvesting. Other research and expertise areas comprise: thermal management of power- and micro-electronics, thermal storage, different types of heat pumps, and district heating and cooling. He is a member of the SiEnE's Experts Group, ASHRAE, ASME, IIR, MRS, and EHPA, Slovenian platform -Smart Buildings and Home with a Wood Chain, member of Executive Board Slovenian Energy Association SZE and Energy Council of the Slovenian Academy of Sciences and Arts.



#### Prof. Ichiro Takeuchi

University of Maryland **Title:** Compression-based elastocaloric cooling: materials, devices, and systems

Ichiro Takeuchi is a professor of materials science and engineering and affiliate professor of physics at the University of Maryland. He received his Ph.D. in physics from the University of Maryland in 1996. Prior to joining the faculty at the University of Maryland, he was a postdoctoral research associate at Lawrence Berkeley National Laboratory, where he helped pioneer the combinatorial materials synthesis strategy. He had also previously worked as a technical staff member in the superconducting electronics group at NEC Corporation. Takeuchi's research interests include high-throughput materials discovery, caloric cooling materials and systems, AI for materials science, and superconducting devices. Takeuchi is also the CTO of Maryland Energy & Sensor Technologies, LLC, a start-up dedicated to commercializing elastocaloric cooling. Takeuchi has published over 300 peer-reviewed journal articles to date. Takeuchi is a fellow of the Materials Research Society, the American Physical Society, and the Japan Society of Applied Physics.



### Prof. Jing-Feng Li

School of Materials Science and Engineering, Tsinghua University **Title:** Thermoelectric cooling materials and emerging applications

Prof. Jing-Feng Li is a Changjiang Scholar Distinguished Professor of Materials Science and Engineering at Tsinghua University, a visiting professor at Tohoku University, Foreign Fellow of Engineering Academy of Japan, Fellow of the American Ceramic Society, Member of IEEE Ferroelectric Standing Committee, board member of International Thermoelectric Society, and also the deputy director of Tsinghua University-Toyota Research Centre. Before joining Tsinghua University as a full professor in 2002, he was an associate professor at Tohoku University. His current research interests include thermoelectric and ferroelectric materials as well as their applications. Prof. Li has published four books and >550 papers in prestigious, top international refereed journals, which have attracted over 31000 citations (H-index=93, highly cited researcher by Clarivate), and has been invited to give >100 plenary/ keynote/invited lectures at international conferences/symposia/workshops. Prof. Li now serves as Editor-in-Chief for Journal of Materiomics and associate Editor-in-Chief for Journal of the Chinese Ceramic Society as well as editorial board members for several international journals.



#### **Prof. Qiming Zhang**

Pennsylvania State University **Title:** Electrocaloric Cooling For A Sustainable World -Where Are We Now?

Qiming Zhang is a Distinguished Professor of Engineering at the Pennsylvania State University, USA. His research covers electronic materials, especially polymers and composites, and their devices and applications. Zhang invented the relaxor ferroelectric polymers which possess record high dielectric permittivity and polymer thin film actuators with giant electroactuation and ultra-high electromechanical coupling factor. The relaxor polymers have been commercialized by Arkema. He founded a high-tech startup, Novasentis, Inc. (was acquired by KEMET in 2019), in commercializing the relaxor polymer thin film actuators and sensors, as well their haptic, wearable, microfluid devices. The company was listed by The Science Coalition in 2013 as one of 100 successful startups created from federally funded university research (Sparking Economic Growth 2.0, Oct. 2013). Since the late 2000s, his group has developed ferroelectric polymers and ceramics with large electrocaloric effect. creating unique opportunity for solid state cooling with high efficiency and zero green greenhouse gas emission. Exploiting the unique features of ECE, his group has developed several solid-state EC cooling devices which have the promise for compact and distributed high efficiency EC coolers. He is a Fellow of IEEE, National Academy of Inventors, and APS.



#### Prof. Dr. Huang Jiaohong

Baotou Research Institute of Rare Earths **Title:** Baotou rare earth industry: a strong support for magnetic materials and application devices

Prof. Dr. Huang Jiaohong, mainly involves in the research and development of rare earth-based magnetic materials (magnetic refrigeration materials and permanent magnetic materials) and application devices such as magnetic refrigeration machine, direct measurement apparatus for magnetic refrigeration material, magnetic separator and different magnetic fields; R&D and preparation of rare earth metals; and design of permanent magnetic paths and magnetic field.

Besides the research fields, Prof. Dr. Huang has taken many social positions, including vice chairman of the Rare Earth Magnetic Refrigeration Materials and Devices Committee of the Chinese Society of Rare Earths , member of the Solid and New Materials Committee, and member of the Thermophysics Committee of the Chinese Society for Measurement; vice president of Baotou Non Party Intellectuals Association; specially appointed researchers/professors/supervisors for master degree students by many research institutions and universities. He was honored the title of Inner Mongolia "Outstanding Contribution Expert" and Inner Mongolia Grassland Talent. From January 2017 to March 2023, He was appointed as the Chief Expert on Rare Earth Magnetic Materials by Baogang Group Company.

He has got many awards such as the First Prize of Inner Mongolia Science and Technology Progress and the First Prize of the Chinese Society of Rare Earths. He has undertaken more than 20 national and Inner Mongolia level scientific research projects. He has published more than 120 academic papers inside and outside China and has patented 70 China's national patents. He has supervised one post-doctoral researcher, two students for doctoral-degree and more than 20 students for masterdegree.

# Programme

# **08/21**Wednesday10:00-22:00RegistrationHotel Lobby (1st floor)19:00-21:00Welcome ReceptionGrand Ballroom A (2nd floor)

### **08/22** Thursday

09:00-09:30	Open	i <b>ng Ceremony</b> G	rand Ballroom A (2nd floor)
09:30-10:00	Plenary Session 1 Grand Ballroom A (2nd floor Solid-State Energy Conversion: Applications and Perspectives Prof. Dr. Andrej Kitanovski, University of Ljubljana Chair: Prof. Fengxia Hu, Institute of Physics Chinese Academy of Sciences		
10:00-10:30	Cof	fee Break & Poster Se	ession
10:30-11:00	<b>Plena</b> Compression-Based Elas Prof. Ichiro Takeuchi, Ur Chair: Prof. Suxin Qian,	ry Session 2 G tocaloric Cooling: Mate iversity of Maryland Xi'an Jiaotong Univer	rand Ballroom A (2nd floor) erials, Devices, and Systems isity
11:00-11:30	Plenary Session 3 Grand Ballroom A (2nd floor) Thermoelectric Cooling Materials and Emerging Applications Prof. Jingfeng Li, Tsinghua University Chair: Prof. Suxin Qian, Xi'an Jiaotong University		
11:30-13:30		Lunch	Xin Cafe (2nd floor)
13:30-15:40	Session A1 Barocaloric Cooling and Materials Grand Ballroom A (2nd floor)	Session B1 Magnetocaloric Devices (1) Junior Ballroom A (1st floor)	Session C1 Magnetocaloric Materials (1) Junior Ballroom B (1st floor)
15:40-16:00	Coffee Break & Poster Session		
16:00-18:45	Session A2 Elastocaloric Materials and Devices Grand Ballroom A (2nd floor)	Session B2 Magnetocaloric Devices (2) Junior Ballroom A (1st floor)	Session C2 Magnetocaloric Materials (2) Junior Ballroom B (1st floor)
18:00-20:00		Dinner	Xin Cafe(2nd floor)
21:00-22:00	IIR Solid State Cooling ar	nd Heating Group meet	ting Dalian (3rd floor)

## **08/23** Friday

09:00-09:30	Plenary Session 4Grand Ballroom A (2nd floor)Electrocaloric Cooling for A Sustainable World - Where Are We Now?Prof. Qiming Zhang, Pennsylvania State University		
	Chair: Prof. Xiaoshi Qiar	n, Shanghai Jiao Tong U	niversity
09:30-09:50	Coffee Break & Poster Session		
	Session A3	Session B3	Session C3
	Electrocaloric	Magnetocaloric	Magnetocaloric
09:50-12:30	Materials and Devices	Devices (3)	Materials (3)
	Grand Ballroom A	Junior Ballroom A	Junior Ballroom B
	(2nd floor)	(1st floor)	(1st floor)
12:30-13:30		Lunch	Xin Cafe (2nd floor)
13:30-14:00	Plenary Session 5Grand Ballroom A (2nd floor)Baotou Rare Earth Industry: A Strong Support for Magnetic MaterialsAnd Application DevicesProf. Dr. Huang Jiaohong, Baotou Research Institute of Rare EarthsChair: Prof. Dr. Andrej Kitanovski, University of Ljubljana		
14:00-14:20	Coffee Break & Poster Session		
	Session A4	Session B4	Session C4
	Optical cooling and	Magnetocaloric	Magnetocaloric
14:20-16:30	Materials	Devices (4)	Materials (4)
	Grand Ballroom A	Junior Ballroom A	Junior Ballroom B
	(2nd floor)	(1st floor)	(1st floor)
16:30-17:00	Closing	Ceremony Gran	d Ballroom A (2nd floor)
19:00-21:00	Banquet	18:00 Gather in th	e Hotel Lobby (1st floor)

### 08/24

Saturday
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	Technical Tour	08:30 Gather in the Hotel Lobby (1st floor)	
	Rare Earth Museum		
09:00-12:00	Lab in Baotou Research Institute of Rare Earths		
	Inner Mongolia Northern Rare Earth Magnetic Materials Co., Ltd.		
	Baotou Jinmeng Magnetic Ma	aterials Co., Ltd.	

# **08/22** Thursday

Session A1: Barocaloric Cooling and Materials Chair: Prof. Fengxia Hu, Institute of Physics Chinese Academy of Sciences		
13:30-13:50	Colossal barocaloric effects: refrigeration and heat storage (keynote) Prof. Bing Li , Shenyang National Laboratory for Materials Science (SYNL), Institute of Metal Research, Chinese Academy of Sciences	
13:50-14:10	Design of barocaloric plastic crystals for room temperature solid- state refrigeration (171) (keynote) Prof. Hui Wang, Central South University	
14:10-14:25	Research of Several Room-Temperature Barocaloric Composite Materials with High Thermal Conductivity Additives (37) Liutao Zhu, Southeast University	
14:25-14:40	Colossal barocaloric effect reversibly driven by low pressure in 2D vdW plastic crystals (34) Yue Kan, Institute of Physics, Chinese Academy of Science	

# **08/22** Thursday

Session A2: Elastocaloric Materials and Devices		
Chair: Prof. Suxin Qian, Xi'an Jiaotong Univerisity		
Prof. I	Huilong Hou, Beihang University	
16:00-16:20	Caloric effect in NI-MN-SN-CO alloy prepared through additive maunfacturing (180) (Keynote) Prof. Xuexi Zhang, Harbin Institute of Technology	
16:20-16:40	A compact two-stage elastocaloric refrigerator with 20 K temperature span (87)(Keynote) Prof. Suxin Qian, Xi'an Jiaotong Univerisity	
16:40-17:00	Additively manufactured high-performance elastocaloric materials and the strain glass transition (163)(Keynote) Prof. Huilong Hou, Beihang University	
17:00-17:15	Elastocaloric effects in all-d-metal Heusler alloys (179) Assistant Professor Zhiyang Wei, Great Bay University	
17:15-17:30	Experimental Research on Compression-driven Multi-layer Tubular Elastocaloric Regenerator (75) GuoQu Zhou, Xi'an Jiaotong Universiity	
17:30-17:45	Nonreciprocal heat transfer enabled elastocaloric cooling (72) Jiongjiong ZHANG, Southern University of Science and Technology	
17:45-18:00	Advanced elastocaloric air cooling by coil-bending with an energy- efficient performance (58) Xueshi Li, The Hong Kong University of Science and Technology	
18:00-18:15	Elastocaloric solid-state refrigeration device based on natural rubber: comparison of materials on a single stage setup (26) SION Marianne, Tohoku University	
18:15-18:30	Design and analysis of an elastocaloric energy conversion device (14) Yao Wang, Xi'an Jiaotong University	
18:30-18:45	Study of the Elastocaloric Effect of Natural Rubber Under Multiple Cycles (88) Yunzhao Zhang, Tianjin University of Commerce	

# **08/23** Friday

Session A3: Electrocaloric Materials and Devices Chair: Prof. Xiaoshi Qian, Shanghai Jiao Tong University		
09:50-10:10	Colossal Electrocaloric Effect in High-Entropy Ferroelectric Working Bodies (181) (keynote) Prof. Xiaoshi Qian, Shanghai Jiao Tong University	
10:10-10:30	Highly efficient thermal management materials and devices based on electrocaloric effect (57) (keynote) Prof. Rujun Ma, Nankai University	
10:30-10:45	<b>Thermoelectric cooling technology: material and applications (151)</b> Prof. Min Zhou, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences	
10:45-11:00	Progress on Power Electronics for Electrocaloric Heat Pump Systems (150) Stefan Mönch(a,b), Richard Reiner(a), Michael Basler(a), Kareem Mansour(a), Daniel Grieshaber(a), Patrick Waltereit(a), Rüdiger Quay(a,c), Kilian Bartholomé(d) (a) Fraunhofer Institute for Applied Solid State Physics (IAF) (b) University of Stuttgart, Institute of Electrical Energy Conversion (IEW) (c) Albert Ludwig University of Freiburg, Department for Sustainable Systems Engineering (INATECH)(d) Fraunhofer Institute for Physical Measurement Techniques (IPM)	
11:00-11:15	Effect of temperature variation rate on the life of thermoelectric devices in PCR instruments (4) Junhao Yan, Huazhong University of Science and Technology	
11:15-11:30	Solid-state thermoelectric cooling based on high-performance bismuth tellurides-based alloys (175) Prof. Chenguang Fu, Zhejiang University	
11:30-11:45	Effects of interfacial compounds inducing by Ag interlayer on the Bi2Te3-based thermoelectric thin film cooler (48) Zeyu Liu, Huazhong University of Science and Technology	

# **08/23** Friday

Session A4: Optical cooling and Materials Chair: Dr. Biao Zhong, Technical Institute of Physics and Chemistry, CAS Prof. Jun Zhang, Institute of Semiconductors, CAS		
14:20-14:40	The effect of doping Yb <sup>3+</sup> concentration on laser cooling characteristics in LuLiF4 crystal (153) (keynote) Dr. Biao Zhong, Technical Institute of Physics and Chemistry, CAS	
14:40-15:00	Laser Cooling of Semiconductors: Progress and Perspective (70) (keynote) Prof. Jun Zhang, Institute of Semiconductors, CAS	
15:00-15:20	Rare earth ions doped fluoride crystals with low phonon energy for laser-induced cooling (keynote) Shanming Li, Shanghai Institute of Optics and Fine Mechanics, CAS	
15:20-15:35	<b>Optical refrigeration in Yb</b> <sup>3+</sup> : <b>YAP crystal (138)</b> Chaoyu Wang, East China Normal University	
15:35-15:50	Spectroscopy and laser-induced cooling characteristics of 4%Yb <sup>3+</sup> : YAG crystals (129) Jiayi Zhang, State Key Laboratory of Precision Spectroscopy, East China Normal	
15:50-16:05	Efficient solid-state laser cooling with excitation of nano-second pulses (82) Associate Professor Guangzong Dong, Tiangong University	

# **08/22** Thursday

### Junior Ballroom A (1st floor)

Session B1: Magnetocaloric Devices (1) Chair: Prof. Jun Shen, Beijing Institute of Technology		
13:30-13:50	High-Performance Thermomagnetic Generator Controlled by a Magnetocaloric Switch (155)(keynote) Prof. Hu Zhang, University of Science and Technology Beijing	
13:50-14:05	Exploring the tradeoff between magnetic circuit and thermal processes in thermomagnetic devices (126) Guilherme Hitoshi Kaneko, Meiji University	
14:05-14:20	Advanced active magnetic regenerator with 3D mesh MnFePSi (125) Bowei Huang, Magneto B.V.	
14:20-14:35	Numerical Simulation of Performance Influencing Factors of Active Magnetic Regenerators in the Temperature Range of 40~60 K (143) Yakun Liu, Beijing Institute of Technology	
14:35-14:50	Machine Learning and high-throughput screening algorithms for optimization of the magnetocaloric effect in all-d Heusler alloys (165) Danil Baigutlin, Chelyabinsk State University	
14:50-15:05	<b>Oscillating Gadolinium thermal switch (152)</b> Dr. Urban Tomc, University of Ljubljana	
15:05-15:20	Room Temperature Magnetocaloric Materials (MnFe) <sub>1.9</sub> (PSi) Fe- Rich Compounds for heat pump application (59) Hanggai H, Delft University of Technology	

# **08/22** Thursday

#### Junior Ballroom A (1st floor)

#### Session B2: Magnetocaloric Devices (2) Chair: Prof. Dr. Oliver Gutfleisch, Technical University of Darmstadt

16:00-16:20	On the magnetocaloric metrics under AC magnetic field (97) (keynote) Prof. Akhmed Aliev, Amirkhanov Institute of Physics of Dagestan Federal Research Centre, Russian Academy of Sciences	
16:20-16:35	Simulation Research on Stages Matching and Timing Sequence Optimization of a Double-stage Adiabatic Demagnetization Refrigerator(ADR) in Ultra-low Temperature Range (116) Zhuo Chen, Beijing Institute of Technology	
16:35-16:50	Numerical Optimization of salt pill in an adiabatic demagnetization refrigerator (113) Dr. Wenshuai Zheng, Beijing Institute of Technology	
16:50-17:05	Improvements on the first magnetic cooling device produced in series: "Polaris" (62) Max Fries, MAGNOTHERM Solutions GmbH	
17:05-17:20	Influence of Velocity Pattern of Heat Exchange Medium Flow on Enhancement of Temperature Span for An Active Magnetic Regenerator (78) Ren Matsushita, Meiji University	
17:20-17:35	Comparison between Simulation and Measurements of an Apparatus for a Thermomagnetic Motor (77) Guilherme Hitoshi Kaneko, Meiji University	
17:35-17:50	Successful integration of a Magnetic Refrigeration System into a refrigerated display cabinet: from simulations to first experimental results (66) Dr. Sergiu LIONTE, Magnoric	

# **08/23** Friday

### Junior Ballroom A (1st floor)

Session B3: Magnetocaloric Devices (3) Chair: Dr. Jingyuan XU, Karlsruhe Institute of Technology		
09:50-10:10	<b>TFORC studies of magnetocaloric materials: models, experiments</b> <b>and beyond (182) (keynote)</b> Prof. Victorino Franco, University of Seville	
10:10-10:30	Magnetic refrigeration: from room temperature to extremely low temperature (keynote) Prof. Zhenxing Li, Beijing Institute of Technology	
10:30-10:45	Influence of the indium thermal interface on the heat transfer in mechanical thermal switch at cryogenics temperature and external magnetic field (74) Konstantin Kolesov, Kotelnikov Institute of Radioengineering and Electronics (IRE) of Russian Academy of Science	
10:45-11:00	Large-scale magnetic cooling unit for industrial applications (64) Dr. Sergiu LIONTE, Magnoric	
11:00-11:15	Giant irreversibility of the inverse magnetocaloric effect in the Ni47Mn40Sn12.5Cu0.5 Heusler alloy (67) Assistant Professor Yurii Koshkidko, Institute of Low Temperature and Structure Research, Polish Academy of Sciences	
11:15-11:30	A magnetocaloric cooling device with layering microchannel magnetic regenerators (69) Jierong Liang, MAGNOTHERM Solutions GmbH	
11:30-11:45	Seasonal COP of a magnetocaloric heat pump for the built environment based on MnFePSi (33) Diego Pineda Quijano, Delft University of Technology	

# **08/23** Friday

### Junior Ballroom A (1st floor)

Session B4: Magnetocaloric Devices (4) Chair: Prof. Wei Dai, Technical Institute of Physics and Chemistry, CAS Prof. Yan WANG, Baotou Research Institute of Rare Earths		
14:20-14:40	Magnetocaloric hydrogen liquefaction-From materials to prototypes (110) (keynote) Dr. Tino Gottschall,Helmholtz-Zentrum Dresden-Rossendorf	
14:40-15:00	A full solid-state conceptual magnetocaloric refrigerator based on hybrid regeneration(19)(keynote) Yuan Lin, Institute of Physics, Chinese Academy of Sciences	
15:00-15:15	Reversible Magnetocaloric Effect Characterized by Low-Cost Lock- In Infrared Thermography (68) Prof. Victorino Franco, University of Seville	
15:15-15:30	Navigating the heat maze: a showcase tutorial of TCCbuilder software (5) Dr. Katja Klinar, University of Ljubljana	
15:30-15:45	Comparative Performance Study of Active Magnetic Regenerative System using Mono/Hybrid Nanofluids (178) Sumit Kumar Singh, Gangneung-Wonju National University	
15:45-16:00	Numerical and experimental study of a reversible thermomagnetic motor (63) Dr. Sergiu LIONTE, Magnoric	
16:00-16:15	High frequency magnetocaloric cooling (144) Urban Tomc, University of Ljubljana	

# **08/22** Thursday

#### Junior Ballroom B (1st floor)

Session C1: Magnetocaloric Materials (1) Chair: Dr. Tino Gottschall, Helmholtz-Zentrum Dresden-Rossendorf Prof. Adler Gamzatov, Amirkhanov Institute of Physics of Dagestan Federal Research Centre of RAS Magnetocaloric high-entropy alloys: prospects and challenges 13:30-13:50 (183) (keynote) Dr. Jia Yan Law, University of Seville Magnetocaloric materials for cryogenic application (159) (keynote) 13:50-14:10 Xin Tang, National institute for Materials Science Magnetic, structural, and magnetocaloric properties of Ni-Co-Mn-Ti Heusler alloys: Insights from ab initio and Monte Carlo approaches 14:10-14:25 (111) Prof. Vladimir Sokolovskiy, Chelvabinsk State University Smart thermoresponsive PNIPAM/FeRh composite activated by magnetocaloric effect for doxorubicin release (161) 14:25-14:40 Dr. Abdulkarim Amirov, Amirkhanov Institute of Physics of Dagestan Federal Research Center, Russian Academy of Sciences Thermomagnetic effect in (Mn,Fe)2(P,Si,B): model, indirect 14:40-14:55 measurements and direct tests (128) Dr. Francois GUILLOU, Inner Mongolia Normal University Inverse Design of Magnetocaloric Materials: From high-throughput 14:55-15:10 to machine learning(16) Wei Liu, TU Darmstadt

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Session C2: Magnetocaloric Mterials (2) Chair: Prof. Victorino Franco, University of Seville Prof. Bing Li , Shenyang National Laboratory for Materials Science (SYNL)		
16:00-16:20	Structural, magnetic, and cryogenic magnetocaloric properties in the GdCoC compound (83) (keynote) Prof. Lingwei Li, Hangzhou Dianzi University	
16:20-16:40	Dynamics of the irreversible inverse magnetocaloric effect in the Ni47Mn40Sn12Cu1 Heusler alloy in cyclic magnetic fields up to 8 T (95) (keynote) Prof. Adler Gamzatov, Amirkhanov Institute of Physics of Dagestan Federal Research Centre of RAS	
16:40-16:55	High-entropy concept shifts the crossover critical point in magnetocaloric materials (93) Dr. Jia Yan Law, University of Seville	
16:55-17:10	Study on Material Arrangement of Multi-Layered Active Magnetic Regenerator with Lanthanum Compound Materials (94) Mr. Yusuke Hanaoka, Meiji University	
17:10-17:25	Magnetocaloric properties of polycrystalline sublimed dysprosium (91) Dr.Sc. Natalia Kolchugina, Russian Academy of Sciences	
17:25-17:40	Formation of ferromagnetic clusters affecting the first-order phase transition in off-stochiometric Fe-Rh (35) Alex Aubert, Functional Materials, TU Darmstadt	
17:40-17:55	Study of the Effect of Microstructure and Configurational Entropy on Magnetocaloric Properties of High-entropy Amorphous Alloys (79) Prof. Lin Xue, Hohai University	

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Session C3: Magnetocaloric Materials (3) Chair: Dr. Jia Yan Law, University of Seville Prof. Lingwei Li, Hangzhou Dianzi University		
09:50-10:10	Martensitic transition and caloric effect in powder and powder- based-processed Ni-Mn-Sn multicaloric Heusler alloys (40) (keynote) Prof. Dr. Oliver Gutfleisch, Technical University of Darmstadt	
10:10-10:25	Impact of fast-solidification on all-d-metal NiCoMnTi based giant magnetocaloric Heusler compounds (71) Dr. Fengqi Zhang, City University of Hong Kong	
10:25-10:40	Production of LaFeSi alloys for high-end magnetic cooling applications (60) Dr. Hugo Vieyra, Vacuumschmelze GmbH & Co. KG	
10:40-10:55	Effect of Si doping on the microstructure and magnetocaloric properties of Gd-based metallic microfibers (42) Shiyang Yu, Inner Mongolia University of Technology	
10:55-11:10	Structural and magnetic disorder in Heusler alloys: Peculiarities of the electronic, magnetic, and vibrational properties of Ni(Co)-Mn-Ti vs. Ni-Mn-(In,Sn) (36) Olga Miroshkina, University of Duisburg-Essen	
11:10-11:25	Rapid phase formation and large magnetocaloric effect in off- stoichiometric La-Fe-Si based alloys for near room temperature applications (109) Huang Xuan, South China University of Technology	
11:25-11:40	La(Fe,Si,Mn)13HZ microparticles stability in different fluids for magnetic refrigeration systems(21) Wei Liu, TU Darmstadt	
11:40-11:55	Laves phases for low temperature magnetocaloric applications (13) Sergey Taskaev, Chelyabinsk State University	

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### Junior Ballroom B (1st floor)

Session C4: Magnetocaloric Materials (4)		
Chair: Prof. Akhmed Aliev, Amirkhanov Institute of Physics of Dagestan Federal		
Research Centre, Russian Academy of Sciences		
Prof. I	Hu Zhang, University of Science and Technology Beijing	
14:20-14:40	Dissecting complexity of phase transitions in first-order multi- caloric materials(15) (keynote) Dr. Konstantin Skokov, Technische Universität Darmstadt	
14:40-14:55	New versatile instruments to measure element-specific and macroscopic hysteresis at ID12 of the ESRF(22) Alex Aubert, postdoctoral researcher, Functional Materials, TU Darmstadt	
14:55-15:10	Controlling microstructure of Gd-based amorphous alloys and its influence on magnetocaloric properties(30) Hangboce Yin, Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences	
15:10-15:25	The role of Debye temperature in achieving large adiabatic temperature changes at cryogenic temperatures: a case study on Pr2In(28) Wei Liu, TU Darmstadt	
15:25-15:40	Influence of high-pressure heat treatment on magnetic and magnetocaloric effects in La0.75Sr0.25Mn0.9Co0.1O3(177) Prof. Xiang Jin, Inner Mongolia Normal University,Baotou Teachers' College	
15:40-15:55	The effect of thermal cycling on magnetocaloric properties of Fe48Rh52 alloy(112) Alexander Kamantsev, Kotelnikov Institure of Radioengineering and Electronics of RAS, Amirkhanov Institute of Physics of Dagestan Federal Research Centre of RAS	

### **Baotou Research Institute of Rare Earths**



Baotou Research Institute of Rare Earths (BRIRE for short hereinafter) was established in 1963, under the direct administration of former Ministry of Metallurgy Industry, and was merged into Baotou Iron & Steel (Group) Company in 1992.

Targeting at comprehensive exploitation and utilization of rare earth resources, BRIRE is an integrated research institute covering the fields of rare earth metallurgy, environmental protection, novel rare earth performance materials, application of rare earths in high technology, rare earth assay & inspection and scientific and technological information services for rare earth industry.

BRIRE has undertaken more than 2300 different project, with nearly 500 patents inside and outside China. It has been awarded more than 300 prizes for research results, including the first prize of national invention award, the first prize of national scientific and technological progress award, etc. Research results developed by BRIRE on rare earth beneficiation, rare earth metallurgy, environmental protection, rare earth functional materials and applications are widely used by rare earth industry till today.

BRIRE has many national and local platforms for research and development, such as "State Key Laboratory of Baiyun Obo Rare Earth Resource Researches and Comprehensive Utilization". Chinese Rare Earth Website (www.cre.net) run by the Institute is an authoritative website on rare earths in China. Professional publications including Chinese Rare Earths, China Rare Earth Information (English version) and Rare Earth Information are issued.

BRIRE has established wide collaboration and academic exchanges with scientific research institutions and universities inside and outside China. The products prepared by BRIRE are sold well both in Chinese domestic and oversea market for their high quality and good reputation. Our products include rare earth oxides, individual rare earth metals, mischmetals, different rare earth functional materials and special rare earth alloys.

BRIRE has done important contribution to the development of China's rare earth industry.

### The State Key Laboratory of Baiyun Obo Rare Earth Resource Researches and Comprehensive Utilization

State Key Laboratory of Baiyun Obo Rare Earth Resource Researches and Comprehensive Utilization was restructured and established in 2022, relying on Baotou Research Institute of Rare Earths, Lanzhou University, and Changsha Mining and Metallurgy Research Institute Co., Ltd., with technical support provided by Zhejiang University.

The Baiyun Obo Mine is a unique tremendous co-existing deposit of iron, rare earth, niobium, and other minerals. It has the largest reserves of rare earths in the world. The reserves of niobium, thorium, and fluorite rank the top one in China and the second globally. The laboratory focuses on the research, development, and comprehensive utilization of complex co-existing resources in Baiyun Obo mine. It develops new mining, beneficiation, and refining processes for rare earth and niobium resources in Baiyun Obo, and new production techniques for high-purity rare earth metals and their alloys, rare earth functional materials, and rare earth devices and their applications.

### China Northern Rare Earth (Group) High-tech Co., Ltd.

China Northern Rare Earth (Group) High-tech Co., Ltd.(China Northern Rare Earth for short) was founded in 1961, with the headquarter located in Baotou city. It is the cradle of China rare earth industry. In 1997, the company was listed on Shanghai Stock Exchange, known as "the first rare earth stock in China". In 2015, China Northern Rare Earth took the lead in completing the establishment of Rare Earth Megagroup, achieving centralized management of light rare earth resources in the north. As of the end of 2023, the company has over 40 subsidiary companies and more than 9600 employees, distributing in 8 provinces and regions including Inner Mongolia, Gansu, Shandong, Hebei, Guangdong, Jiangxi, Fujian, and Beijing. The total assets reach 40.497 billion yuan and the total market value is 69.9 billion yuan. In 2023, the company achieved a revenue of 33.497 billion yuan and a profit of 3.132 billion yuan, making it the largest, highest output, and the most profitable leading enterprise in the rare earth industry.

China Northern Rare Earth undertakes the important mission of developing and strengthening the rare earth industry chain in China and even globally, and building a high-quality rare earth ecosystem. Relying on the unique resource advantages of Baiyun Obo Mine, China Northern Rare Earth has established the largest rare earth raw material production base and rare earth functional material manufacturing base in the world. Main business of the company includes scientific research and development, refining & separation, deep processing, comprehensive utilization of renewable resources, and import and export trade, covering the entire rare earth industry chain. It can produce a total of 11 categories, more than 50 types, and nearly a thousand specifications of various rare earth products. China Northern Rare Earth has the top one rare earth raw material supply capacity in the world. It has the world top one production capacity of rare earth magnetic material alloys and more than half of the Chinese domestic market share of the polishing materials. Besides, it has the capability to produce 1270 sets of rare earth permanent magnet motors per annum. It is the largest rare earth product supplier in China and even the world, with the destinations inside China and oversea countries and regions such as the United States, the European Union, and Japan.

China Northern Rare Earth firmly follows a new path of high-quality development guided by ecological priority and green development. It is a pioneer of clean production in rare earth industry, achieving "zero discharge" of production wastewater, the emission of exhaust gas meeting regulation requirement, and the compliant disposal of waste residue. Focusing on the carbon footprint, the company took the lead in drafting the first carbon emission accounting standard and constructing the first EPD platform in China's rare earth industry. China Northern Rare Earth has made important contributions to promote the low-carbon and green development of rare earth industry.





### **Baotou Rare Earth Museum**

Baotou Rare Earth Museum is located within Baotou Research Institute of Rare Earths in Baotou, Inner Mongolia. After refurbishment, it re-opened to public in June 2022. This museum is currently the solely known themed museum in China that comprehensively showcases the development history of China and even the world's rare earth industry.

Baotou Rare Earth Museum comprehensively displays the discovery of rare earth elements, the formation and distribution of rare earth minerals, rare earth technology processes, scientific research and development, and the development history of the world and China's rare earth industry, especially the remarkable achievements got in China's rare earth industry under the leadership and attention of the government. The museum is a solid history and encyclopedia of rare earth industry development.

The Baotou Rare Earth Museum fully utilizes modern exhibition methods of digitization, enhancing the interactivity, innovation, and playfulness experiences. More than 650 valuable showpieces are exhibited, including historical documents, historical objects, rare earth raw materials, functional materials, and terminal application products related to the development of the rare earth industry, such as original report by Mr. Ding Daoheng, who was the first scientist discovered the world famous Baiyun Obo mine.



### **Baotou Jinmeng Magnetic Materials Co., Ltd.**

Baotou Jinmeng Magnetic Materials Co., Ltd. (JMHC) was established in 2008 and is located in Baotou Rare Earth High-Tech Industrial Development Zone. As a professional high-tech enterprise specializing in research and development, production, and sales of rare earth permanent magnetic materials, the company mainly focuses on sintered NdFeB, bonded NdFeB, and rare earth metals. It has a complete production line including rare earth metal, smelting, NdFeB material production, infiltration processing, finished product processing, surface treatment, and rare earth waste recycling.

The company produces 6,000 tons of high-performance rare earth permanent magnetic materials annually, and has already mass produced a series of high-performance NdFeB permanent magnet materials, including N56, 56M, 56H, 54SH, 54UH, 48EH, and 42TH. JMHC possesses the world leading equipment for R&D, production and inspection. It has been certified by a complete production process management system, including IATF 16949:2016 International Automotive Quality Management System, ISO 9001:2015 Quality Management System, ISO 14001:2016 Environmental Management System, ISO45001:2018 Occupational Health and Safety Management System certifications, as well as the SCS Global Services (recycled component certification system), ensuring the green, stable, high-quality, and the cost-effective products.

The company has a strong R&D team. After years of innovative development, it has obtained multiple core patents in the production of magnetic materials. The company has been recognized as a national-level high-tech enterprise, an Enterprise Technology Center of Inner Mongolia Autonomous Region, a Specialized and New Demonstration Enterprise of Inner Mongolia Autonomous Region, an Industrial Design Center of Inner Mongolia Autonomous Region, an Industrial Design Center of Inner Mongolia Autonomous Region, a Service Manufacturing Pilot Demonstration Enterprise of Baotou City, and an Industrial Internet Pilot Enterprise.

As a member of China Northern Rare Earth Group, JMHC has a stake in China Northern Rare Earth Group. Through equity cooperation with the Group, JMHC has

stable rare earth raw materials supply. Leveraging the full industry chain of Jinmeng Group, JMHC strengthens the supply-demand connection with key enterprises, establishes upstream and downstream cooperation mechanisms, effectively manages every link from rare earth raw materials to the manufacturing of NdFeB magnets, and constructs a stable and open raw material security system.

With the strong technical expertise and manufacturing advantages, Baotou Jinmeng Magnetic Materials has established close strategic partnerships with leading enterprises in various industries at home and abroad. Its products are widely used in the fields such as automobiles, robots, intelligent manufacturing, audio, 3C, etc. The company provides customers with stable and high-quality products and services.




10th IIR Conference on Caloric Cooling and Applications of Caloric Materials (THERMAG 2024)

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#### Liaison THERMAG 2024 Secretariat

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