MATERIALS FOR EXTREMES

Beyond Nickel-Based Superalloys V

Materials for Extreme Environments

29 June - 2 July 2026
Alan Walters Building,
University of Birmingham

Contents

Welcome to Beyond Nickel-Based Superalloys

This is the fifth conference of the established BNBS series, following the successes of Bad Berneck (Germany) 2013, Cambridge (UK) 2016, Nara (Japan) 2019, and Potsdam (Germany) 2023.

It will focus on those metallic materials and alloys that have the potential to deliver superior properties compared to Nickel-Based Superalloys and brings together international representatives from industry and academia.

We are pleased to have received an array of talk and poster contributions covering a wide range of themes and from a variety of international academic and industrial organisations. We've planned a single-session format, with wach presentation session following a curated theme, from refractory metals to next generation silicides, and bcc-superalloys to nuclear applications and advanced testing approaches.

Many thanks go out to the BNBS-V Committee, including:

- Kyosuke Yoshimi
- Sebastian Kube
- Kan Ma
- Christopher Zenk
- Ayan Bhowmik
- Lesley Cornish
- Oleg Senkov
- Jean Philippe Couzine
- Anke Silvia Ulrich
- Uwe Glatzel
- Katerina Christofidou
- Ed Pickering
- Tamsin Whitfield
- Sandy Knowles
- Akane Suzuki

On Monday we open with Registration and Refreshments in the Atrium at 8.30 a.m. With the Presentations beginning at 9.00 a.m. in the Lecture Theatre. The Poster Exhibition Evening, with drinks reception and hot buffet, begins at 6.00 p.m. in the Atrium.

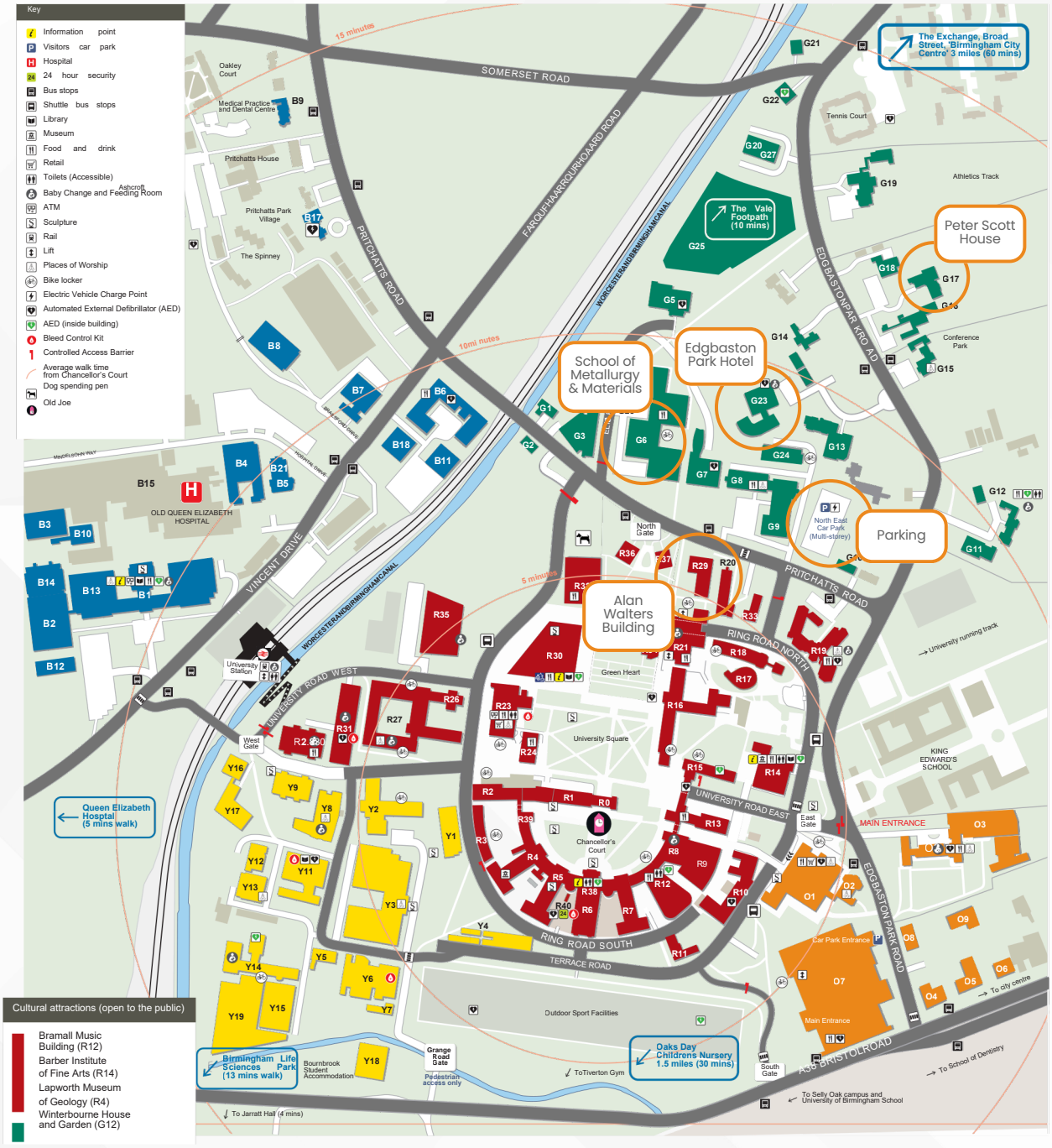
On Tuesday we have a half day programme to allow the afternoon for delegates to explore Birmingham and enjoy some downtime. Some suggestions are listed on page 16.

The programme continues through Wednesday, when we also look forward to welcoming you to the Drinks Reception and Conference Dinner in the Fry Suite at the Edgbaston Park Hotel from 6.00 p.m.

On Thursday our final sessions span the morning, closing the conference with Awards ahead of a final lunch together.

Edgbaston

Campus Map



www.birmingham.ac.uk/contact/directions

Invited Speakers

Taichi ABE | National Institute for Materials Science

Thermodynamic database of MoSiBTiC-X systems for microstructural analysis

Chihana KUDO [1], Yusuke MATSUOKA (NIMS), Katsunari OIKAWA [1], Kyosuke YOSHIMI [1]
(1 Tohoku University)

The microstructures of MoSiBTiC alloys consist of multiple phases, which are mainly Mo solid solution (Mo_ss), Mo5SiB2(τ2), Mo2C, Mo2B, and TiC. To understand the evolution of their complex structures and to find the optimum conditions for the MoSiBTiC-based alloys, computational thermodynamics based on the CALPHAD (CALculation of PHAse Diagrams) method has significant advantages for estimating various phase equilibria under given conditions.

Recently, one of the authors (K.O) constructed a CALPHAD database for the fundamental system, Mo-Si-B-Ti-C quinary, where the associate solution model was applied to the liquid phase. Using this database, phase equilibria can be estimated from the thermodynamic calculations using several software packages (Pandat, Thermo-Calc, and CatCalc) to understand the complex microstructures of MoSiBTiC-based alloys. Under the Scheil condition (no diffusion in solid, infinitely fast diffusion in liquid), various indexes (cooling curves, heat capacity curves and solidification cracking susceptibility, etc.) were estimated and compared with experimentally observed microstructures taken from as-cast/heat-treated specimens to understand the complex microstructures of MoSiBTiC-based alloys. Moreover, based on the fundamental database, in the present work, we tried to add a six-th element and examined its effects on the phase constitutions. The results will be presented and discussed in the presentation.

Session 1: Monday 29 June 0900-1030

Ida Berglund | Thermo-Calc Solutions

Turning alloy concepts into hardware: CALPHAD in action

John Aristeidakis, Fuyao Yan (Thermo-Calc Solutions)

This talk will demonstrate how CALPHAD tools can be practically applied to accelerate the development of advanced alloys, going beyond incumbent Ni-based superalloys. The development of new or improved alloys, especially for demanding applications such as those in aerospace and space, is traditionally a decade-long process, constrained by vast multicomponent design spaces and extensive experimental iteration. Increasingly, this challenge is addressed through expanded digital infrastructure that integrates physics-based models, high-quality databases, and computational tools. Here, we demonstrate how CALPHAD databases and tools serve as a central element of this infrastructure for materials engineering (i.e., ICME), specifically exemplifying how it enabled the transition from an alloy design idea to a

functional additively manufactured refractory alloy thruster prototype in just three years, surpassing incumbent alloys such as IN718 in performance. Using the Thermo-Calc software and the TCHEA high-entropy alloy database, a CALPHAD-guided design–build–test–learn workflow was used to rapidly down-select viable compositions, evaluate phase stability and solidification pathways, and direct focused experimental validation. Coupled with digital tools and rapid development testing strategies, this approach highlights how CALPHAD-enabled digital infrastructure accelerates alloy development.

Session 9: Wednesday 1 July 1330-1500

Adrien Couet | University of Wisconsin-Madison

High Throughput Research of Ordered-Precipitate BCC Compositionally Complex Alloys for Advanced Nuclear Environments

Next-generation nuclear technologies, including high-power particle accelerators and fusion reactors, will impose extreme thermo-mechanical loading and intense irradiation on beam windows, targets, and plasma-facing materials. Conventional low-Z materials experience premature degradation from radiation-induced hardening and embrittlement, swelling, and reduced thermal conductivity, motivating alloy design strategies beyond traditional Ni-based superalloys. We explore precipitation-strengthened, low-activation BCC compositionally complex alloys as a platform to simultaneously thermal transport, and irradiation tolerance for accelerator and fusion environments.

Building on recent progress in ordered-phase strengthening, we focus on dual-phase BCC matrices reinforced with ordered B2/L21 precipitates, designed to act as stable, high-density defect sinks while retaining matrix ductility and resistance to thermal shock. CALPHAD-guided alloy design is coupled with rapid synthesis enabled by autonomous additive manufacturing, followed by high-throughput irradiation and multiscale characterization, to map how precipitate structure, volume fraction, coherency, and chemistry govern defect evolution and property degradation.

For beam window applications, preliminary results in a V-rich low-density BCC alloy containing coherent CoAlTi-type L21 nanoprecipitates demonstrate precipitate stability to high dose, reduced irradiation hardening with increased compositional complexity, and a strong sensitivity of swelling to precipitate volume fraction, revealing a non-trivial tradeoff between strengthening and void nucleation. For plasma-facing materials, ongoing work emphasizes the TaTiVW system as a model single-phase BCC platform.

Current efforts directly compare matched B2 and L21 precipitate systems and integrate near-surface thermal transport metrology to quantify irradiation-driven conductivity losses relevant to thermal shock. The resulting framework provides actionable design rules to extend superalloy-inspired microstructural engineering into radiation-dominated nuclear applications.

Session 5: Tuesday 30 June 0900-1030

Carolina Frey | ATI SA&C

Design of BCC-B2 Precipitation Strengthened Nb-based Alloys

Benjamin Neuman [1], Sebastian Kube [2], Kaitlyn Mullin [3], Anthony Botros [1], Haojun You [1], Tresa Pollock [1]
(1 University of California, 2 University of Wisconsin-Madison, 3 Max Planck Institute for Sustainable Materials)

Refractory metals and alloys are key materials for high temperature applications. However, the development of new structural materials that can operate at desired temperatures of 1300-1400 °C has been limited by a lack of coherent strengthening precipitates that can persist at the target temperatures. This presentation reviews the possibility of using the platinum-group element Ru to form coherent B2 precipitates in Nb-based alloys. Alloys in the Hf-Mo-Nb-Ta-V-Ru system were annealed in vacuum between 1000-1900 °C and investigations of their microstructures by SEM and TEM demonstrate that coherent precipitation of HfRu and ZrRu precipitates in a Nb-based matrix is achievable and tunable. Microstructural trends and design guidelines for Nb-based alloys are established, including trends for precipitate volume fraction and solvus temperatures. At the end, key challenges and new investigations into alternative B2 formers, such as Re, will be discussed.

Session 2: Monday 29 June 1100-1230

Ryuta Kasada | Tohoku University

Microstructural Pathways to Enhanced Damage Tolerance in ODS Alloys for Advanced Nuclear Power Systems

Hao YU, Diancheng GENG, Zimo GAO, Yuki OGAWA, Toshiki SAITO, Jaeyoon BAE, Feifan HE, Minha PARK, Sosuke KONDO

Oxide dispersion strengthened (ODS) alloys are among the most promising candidates for structural applications in future fission and fusion power systems, where extreme operating conditions combine high temperatures, intense neutron flux, and hydrogen and helium transmutation. Numerous studies on ODS ferritic steels have demonstrated that tailored nano-oxide dispersions can suppress irradiation embrittlement and void swelling.

Beyond traditional ODS ferritic steels, we have proposed a new alloy design strategy incorporating Al-added high-Mn ODS austenitic steels for fusion blanket components, addressing challenges associated with magnetic compatibility, oxidation resistance, and liquid-metal corrosion.

In parallel with ODS steels, ODS–Cu alloys have emerged as attractive candidates for heat-sink applications in fusion divertor and other high-heat-flux components. Our new Cu–Y–Zr–WO_3 ODS–Cu alloys combine superior thermal conductivity with enhanced high-temperature strength, offering a potential route to extending divertor lifetime.

In this conference, additional novel ODS alloys with architected microstructural hierarchies will be presented.

Session 5: Tuesday 30 June 0900-1030

Alexander Kauffmann | Ruhr University Bochum

Overcoming Fundamental Barriers for Novel Refractory High Temperature Candidate Alloys in Cr-Mo-Si Alloys

Frauke Hinrichs [1], Georg Winkens [1], Lena Katharina Kramer [1], Gabriely Falcão [1], Ewa M. Hahn [1], Daniel Schliephake [1], Michael Konrad Eusterholz [1], Sandipan Sen [1], Mathias Christian Galetz [2], Haruyuki Inui [3], Martin Heilmaier [1]
(1 Karlsruhe Institute of Technology, 2 DECHEMA, 3 Kyoto University)

Despite advancements in renewable energy, enhancing energy conversion efficiency from fossil or synthetic fuels remains crucial, especially for long-range aircraft. To increase turbine operating temperatures beyond 1,050–1,150 °C, it is necessary to replace Ni-based superalloys with refractory-element-based materials that have solidus temperatures exceeding 2,000 °C. This study presents a single-phase Cr-36.1Mo-3Si (at.%) solid solution alloy that meets key requirements for refractory-element-based alloys: resistance to pesting, nitridation, and scale spallation up to 1,100 °C, along with unexpected room-temperature compression ductility. Previous efforts to improve oxidation/corrosion resistance and ductility in such alloys have proven challenging. The Cr-36.1Mo-3Si alloy was synthesized via arc melting, with a Cr/Mo ratio of 1.7 and 3 at.% Si to prevent silicide formation, unlike than in other pesting-resistant high-Mo containing alloys. Additionally, a Si-free Cr-37.2Mo alloy was synthesized to investigate the role of Si in scale formation and passivation. The alloy design utilizes Cr for Cr2O3 scale formation, Mo enrichment of the sub-scale region to prevent nitridation, and Si for slow Cr2O3 scale growth and impediment of Mo oxidation and evaporation. The study confirms the formation of a single-phase, disordered solid solution, enabling ductility through dislocation slip and deformation twinning. The presentation will outline the fundamental aspects required to achieve oxidation resistance, as well as the activation of the deformation mechanisms identified in this promising material.

Session 4: Monday 29 June 1530-1700

Manja Krüger | Otto-von-Guericke University

Alloy design for Mo-based silicide materials to tailor the mechanical and oxidation response

Christopher Schmidt, Dennis Zang, Julia Becker, Georg Hasemann (Otto von Guericke University)

Refractory metal-based alloys are attractive candidates for high temperature structural applications, especially when combining a ductile and tough solid solution phase with creep and oxidation resistant silicide phases. The properties of this type of multi-phase materials is significantly affected by the microstructural design, i.e. the chemical composition of the solid solution phase using various alloy additions, the volume fraction and homogeneous distribution of the solid solution phase and the silicide phases, the grain size and orientation as well as the concentration of dissolved detrimental impurities and impurity phases. Balancing the ambient and high temperature properties of such alloys requires to tailor their microstructures. This needs an optimization of the chemical composition using additional alloying elements and the modification of alloying concepts with respect to the manufacturing methods. Analysing the solidification path to understand microstructural evolution or – in other cases- the diffusion mechanisms during sintering is essential. However, processing of refractory metals and alloys is quite challenging due to the ultra-high melting point above 2000°C and their strong tendency to oxidize at intermediate temperatures. Different processing routes of multi-phase Mo-Si-B alloys by powder metallurgical (PM) routes, directional solidification (DS) processes and laser-based additive manufacturing (AM) techniques will be presented. It will be shown that the AM materials are crack-free and the constituents are homogeneously distributed. The microstructure is very fine as can be compared to powder metallurgically processed Mo-Si-B. Interestingly, the brittle-ductile-transition temperature of AM Mo-Si-B materials is lower as compared to similar alloy

compositions produced by other processing methods. Creep response is investigated by stress-controlled creep tests at temperatures > 1000°C. In general, the creep resistance of Mo-Si-B alloys depends not only on the microstructure size scale but also on the morphology and volume fraction of the weak Mo solid solution phase and the creep resistant silicide phases. Furthermore, the experimental data were used as a basis for thermal and mechanical analyses by the finite element method using a simple turbine blade geometry.

Session 1: Monday 29 June 0900-1030

Kan Ma | City University of Hong Kong

Novel chromium-based BCC-superalloys enhanced by intermetallic B2 cobalt-aluminum

Xianbing Zhang [1], Thomas Blackburn [2], Íris Carneiro [2], Cheng Ding [2], Jie Wang [3], Mengmeng Wang [4], Minghao Ma [1], Zeyu Xia [5], Sibo Cheng [6], Binbin He [7], Alexander J. Knowles [2], Kan Ma [1, 2]
(1 City University of Hong Kong, 2 University of Birmingham, 3 Shanghai Jiao Tong University, 4 Anhui Polytechnic University, 5 University of Virginia, 6 Institut Polytechnique de Paris, 7 Southern University of Science and Technology)

To enable higher thermal efficiency in next-generation concentrated solar power systems, structural materials capable of sustained operation at 700–1000 °C are required, surpassing the limits of conventional Ni-based superalloys. Inspired by the dual-phase γ/γ′ design paradigm of face-centred cubic superalloys, a similar matrix/precipitate strategy has been successfully extended to body-centred-cubic systems, yielding Cr-based alloys with an A2/B2 (β/β′-type) architecture, representing a promising design strategy for extreme-temperature applications. This work investigates the Cr-Co-Al system which fulfils this paradigm, leveraging the exceptionally high solubility of CoAl in the A2-Cr matrix (>40 at.%) to enable tunable B2 volume fractions with minimal lattice misfit (~-0.5%). Alloys fabricated by vacuum melting, homogenised at 1450 °C for 20 h, and aged at 1000 °C for 4–240 h exhibited nanoscale B2-CoAl precipitates forming even during water quenching, with deep-learning-assisted image analysis revealing remarkably sluggish coarsening kinetics. In Cr-20Co-10Al, B2 precipitates initially assembled into pseudo-spherical clusters that evolved into well-defined spherical particles upon prolonged ageing. Hardness measurements demonstrated peak strengthening in the homogenised condition, with Cr-20Co-10Al retaining nearly twice the hardness of its 240 h-aged state at 1000 °C and outperforming a B2-free Cr-10Co control, highlighting the synergistic effects of precipitation and solid-solution strengthening. These findings establish Cr-Co-Al as a highly promising B2-reinforced BCC alloy system for high-temperature structural applications and provide a materials design foundation for novel BCC superalloys.

Session 3: Monday 29 June 1330-1500

An-Chou Yeh | National Tsing Hua University

Grain-Boundary Engineering and Elevated-Temperature Properties of LPBF-Compatible $L1_2$-Strengthened High-Entropy Alloys

Laser powder bed fusion (LPBF) offers unprecedented fabrication freedom for high-temperature alloys; however, conventional $L1_2$-strengthened Ni-based superalloys with high fractions of gamma-prime phase can suffer from poor printability and limited high-temperature ductility. Here, we integrate entropy-enabled alloy design with grain-boundary

engineering to develop LPBF-compatible medium-to-high-entropy alloys exhibiting a synergistic combination of oxidation resistance, creep and tensile performance. Using an Al–Co–Cr–Fe–Ni–Ti-based $L1_2$-strengthened high-entropy alloy as a model system, we demonstrate that ppm-level yttrium microalloying effectively suppresses grain coarsening during super-solvus homogenization, preserving a fine-grained microstructure after heat treatment. Multiscale characterization reveals that yttrium does not modify FCC/$L1_2$ phase partitioning; instead, it segregates selectively to grain boundaries, where thermally stable Y-rich oxides generate strong Zener pinning and enhance grain-boundary cohesion. Consequently, the Y-bearing HEA achieves a well-balanced combination of strength and ductility at 750–900 °C. In addition, HEAs that exhibit excellent LPBF printability, the formation of protective α-Al_2O_3 scales during oxidation, and outstanding long-term creep resistance at 650 °C will be presented.

Session 10: Wednesday 1 July 1530-1710

Christopher Zenk | Friedrich-Alexander-Universität

Microstructure Evolution and Mechanical Properties of Ferritic Superalloys

Luis Morales, Kai Eberl, Andreas Bezold, Ashton Egan, Steffen Neumeier (Friedrich-Alexander-Universität)

Ferritic superalloys are based on the Fe–Al–Ni ternary system and exhibit a coherent bcc-derived α/α′ (A2/B2) microstructure. Comprised of roughly two-thirds Fe and Al by weight, these alloys go “beyond” Ni-base superalloys—not in temperature capability, but in cost efficiency.

The addition of Ti facilitates the partial transformation of α′ into an $L2_1$ Heusler phase, referred to as α″. The introduction of these precipitates has been shown to improve creep resistance at 700 °C by four orders of magnitude.

We present results from our own alloy development in this field, leading to the alloy FSA2 with a high precipitate fraction (~50%). High-energy X-ray diffraction reveals a complex phase transformation pathway, enabling the design of a wide range of microstructures. High-temperature tensile tests show a relatively high yield strength (~1 GPa), but poor low-temperature ductility. Various embrittlement mechanisms are active at temperatures up to 1000 °C.

Session 10: Wednesday 1 July 1530-1710

Poster Exhibition

The poster exhibition will be on display in the Atrium from Monday to Wednesday, with a dedicated exhibition evening with buffet and drinks reception on Monday evening.

Number	Poster
01	**Dr. Iris Carneiro** | University of Birmingham **Inert Anode Design for Molten Salt and Molten Oxide Electrolysis of Clean Steels** *Ian Mellor [1], Alexander Brook [1], James Hickey [2], Mark Allan [3], Peter Polcik [4], Alexander J Knowles [5]* *(1 Metalysis Limited, 2 Ironic Metals Ltd, 3 MPI, 4 Plansee Composite Materials, 5 University of Birmingham)*
02	**Dr. Vincent Gagneur** | University of Birmingham **Precipitation Induced Recrystallisation (PIX) in undeformed high misfit dual phase alloys** *Kan Ma 1, Neal Parkes 2, Vivian Tong 3, Ben Poole 4, Chris Hardie 4, Alexander Knowles 2* *(1 City University of Hong Kong, 2 University of Birmingham, 3 TU Bergakademie Freiberg, 4 UKAEA)*
03	**Joshua Hobbins** | Bangor University **Thermodynamic evaluation of precipitate phases in fusion steels** *Theresa Davey (Bangor University)*
04	**Luke Howard** | University of Birmingham **Irradiation performance of novel Fe-Cr-Ni-Si silicide intermetallics** *Matthew Lloyd [1], Sang Pham [1], James Gibson [2], David Bowden [2], Sandy Knowles [1]* *(1 University of Birmingham, 2 UKAEA)*
05	**Chihana Kudo** | Tohoku University **Effect of Laser Surface Remelting on Microstructure and Cracking Behavior of MoSiBTiC Alloys** Tuğrul Talha Ersöz [1], Yuanbo Tony Tang [1], Kyosuke Yoshimi [2] (1 University of Birmingham, 2 Tohoku University)
06	**Sudhansu Maharana** | Indian Institute of Technology Kharagpur **Planar-fault-mediated strengthening and sustained strain hardening in an $L1_2$-strengthened Ni-rich high-entropy alloy at elevated temperature** *Manashi Sabat, Tapas Laha (Indian Institute of Technology Kharagpur)*
07	**Hiromu Matsuura** | Tohoku University **Evaluation of Material Properties of Constituent Phases in MoSiBTiC Alloys Using Moment Tensor Potential** *Ridwan Sakidja (Missouri State University), Kyosuke Yoshimi (Tohoku University)*
08	**Noel Raison** | University of Birmingham **High-Throughput Combinatorial Discovery & Demonstration of Novel Fusion Alloys**
09	**Vikram Raja** | Karlsruhe Institute of Technology **Novel Ti-based A2-B2 Refractory Compositionally Complex Alloys** *Amin Radi [1], Sandipan Sen [1], Daniel Schliephake [1], Chongchong Tang [1], R.J. Vikram [1], Bronislava Gorr [1], Martin Heilmaier [1], Alexander Kauffmann [1,2] (1 Karlsruhe Institute of Technology, 2 Ruhr University Bochum)*

Number	Poster
10	**Toni Renz** | University of Oxford **Impact of Cr on A2+B2 microstructures in refractory superalloys** *Tamsin Whitfield, Angus Wilkinson (University of Oxford)*
11	**Ethan Sumner** | University of Birmingham **Irradiation characterisation of novel near alpha zirconium for fission and Gen IV** *Alexander Knowles [1], Helen Swan [2], Johan Pauli Magnussen [3, 1] (1 University of Birmingham, 2 NNL, 3 UKAEA)*
12	**Colin Teoh** | University of Oxford **Microstructural Evolution in the Ti-V-(Cr,Nb)-Ta High Entropy Alloy Compositional Tie-Line** *Angus J. Wilkinson, David E.J. Armstrong (University of Oxford)*
13	**Lars Thielemann** | Otto-von-Guericke University Magdeburg **Powder Metallurgical Synthesis of V5SiB2 and V8SiB4 Intermetallic Phases** *Georg Hasemann [1], Manja Krüger [1], Weiguang Yang [2], Ruth Schwaiger [2, 3], Bronislava Gorr [4]* *(1 Otto-von-Guericke University Magdeburg, 2 Forschungszentrum Jülich GmbH, 3 RWTH Aachen University, 4 Karlsruhe Institute of Technology)*
14	**Dr. Nihan Tuncer** | Foundation Alloy **High ductility in as-sintered Mo-based alloys** *Roman Boychuk, Madison Gianelle, Trevor Marchhart, Erin McDevitt, Christian Oliver, Alex Zwiren, Ian Dowding (Foundation Alloy)*
15	**Deepan Sam Leo Xavier** | Coventry University **Energy-Efficient Processing of Refractory High Entropy Alloys via a Powder Route: Microstructural Examination of Parts Manufactured using Field Assisted Sintering Technology** *Masoumeh Faraji, Michael E. Fitzpatrick (Coventry University)*
16	**Dawei Zhou** | Chalmers University of Technology **Grain Boundary Segregation of Metallic Elements: A Novel Strategy for Enhancing the Ductility of Refractory Alloys** *Sheng Guo (Chalmers University of Technology)*
17	**Dr. Lu Zhu** | Chalmers University of Technology **Recycling of industrial wastes for advanced ultrahigh-temperature protective coatings** *Sheng Guo (Chalmers University of Technology)*

Programme

Day 1 - Monday 29 June

0830-0900	Atrium	**Registration and Refreshments**
0900-1030		**Session 1: Design of Mo-based silicides** Chair: Prof. Sandy Knowles | University of Birmingham
Prof. Manja Krüger | Otto von Guericke University **Alloy design for Mo-based silicide materials to tailor the mechanical and oxidation response** *Christopher Schmidt, Dennis Zang, Julia Becker, Georg Hasemann (Otto von Guericke University Magdeburg)*		
Dr. Taichi ABE | National Institute for Materials Science (NIMS) **Thermodynamic database of MoSiBTiC-X systems for microstructural analysis** *Chihana KUDO [1], Yusuke MATSUOKA [2], Katsunari OIKAWA [1], Kyosuke YOSHIMI [1] (1 Tohoku University, 2 NIMS)*		
Prof. Naoyuki Nomura | Tohoku University **Particle-Level Compositional Design of MoSiBTiC Alloys via FD- POEM and Plasma Spheroidization** *Ryo Kanamura, Mingqi Dong , Zhenxing Zhou, Weiwei Zhou (Tohoku University)*		
Toni Renz | University of Oxford **Phase Stability in the Mo-Si-Ti system** *Nicole Church, Giulio Lampronti, George Wise, Charley Craig, Howard Stone, Nick Jones, Rob Thompson (University of Cambridge)*		
1030-1100	Atrium	**Refreshments**
1100-1230		**Session 2: Bcc-superalloys (1)** Chair: Dr. Tamsin Whitfield | University of Oxford
Dr. Carolina Frey | ATI SA&C **Design of BCC-B2 Precipitation Strengthened Nb-based Alloys** *Benjamin Neuman [1], Sebastian Kube [2], Kaitlyn Mullin [3], Anthony Botros [1], Haojun You [1], Tresa Pollock [1]* *(1 University of California, 2 University of Wisconsin-Madison, 3 Max Planck Institute for Sustainable Materials)*		
Dr. Kateryna Khanchych | Karlsruhe Institute for Technology (KIT), Germany **Ta-Mo-Cr-Ti-Al-based refractory high-entropy alloy coatings for high-temperature applications** *Michael Stüber, Chongchong Tang, Carsten Schroer, Bronislava Gorr (Karlsruhe Institute of Technology)*		
Dr. Nataliya Yadzhak | University of Bayreuth **Evaluation of Hydrogen Effect on Fe-Ni-Al bcc Superalloys by Resonance Ultrasound Spectroscopy** *Lukas Deichsel, Rainer Völkl, Uwe Glatzel (University of Bayreuth)*		
Zi-Kui Lu | Pennsylvania State University **Beyond Ni-Based Superalloys: Data-Driven Design of Eutectic Refractory Alloys for Ultrahigh-Temperature Turbine Applications**		
1230-1330	Atrium	**Lunch**

1330-1500		**Session 3: Advances in Chromium Alloys** Chair: Prof. Katerina Christofidou | University of Sheffield

Dr. Kan Ma | City University of Hong Kong
Novel chromium-based BCC-superalloys enhanced by intermetallic B2 cobalt-aluminum
Xianbing Zhang [1], Thomas Blackburn [2], Íris Carneiro [2], Cheng Ding [2], Jie Wang [3], Mengmeng Wang [4], Minghao Ma [1], Zeyu Xia [5], Sibo Cheng [6], Binbin He Southern [7], Alexander J. Knowles [2], Kan Ma [1,2]
(1 City University of Hong Kong, 2 University of Birmingham, 3 Shanghai Jiao Tong University, 4 Anhui Polytechnic University, 5 University of Virginia, 6 Institut Polytechnique de Paris, 7 Southern University of Science and Technology)

Julie Hammoud | Technische Universität Darmstadt
Deformation mechanisms in Cr-Mo-Si alloys: Insights from atomistic simulations based on first-principles calculations and machine learning interatomic potentials
Karsten Albe (Technische Universität Darmstadt)

Jan Vollhüter | Friedrich-Alexander-Universität
Hierarchically structured bcc superalloys in the Cr-NiAl system
Mathias Göken, Steffen Neumeier (Friedrich-Alexander-Universität)

Pelle Wolf | DECHEMA
Cr-V Binary Alloys: High Temperature Oxidation Behavior and Hardness
Emma White, Mathias Galetz (DECHEMA)

1500-1530	Atrium	**Refreshments**
1530-1700		**Session 4: Advances in Chromium Alloys** Chair: Dr. Christopher Zenk | Friedrich-Alexander-Universität

Prof. Alexander Kauffmann | Ruhr University Bochum
Overcoming Fundamental Barriers for Novel Refractory High Temperature Candidate Alloys in Cr-Mo-Si Alloys
Frauke Hinrichs [1], Georg Winkens [1], Lena Katharina Kramer [1], Gabriely Falcão [1], Ewa M. Hahn [1], Daniel Schliephake [1], Michael Konrad Eusterholz [1], Sandipan Sen [1], Mathias Christian Galetz [2], Haruyuki Inui [3], Martin Heilmaier [1]
(1 Karlsruhe Institute of Technology, 2 DECHEMA, 3 Kyoto University)

Assoc. Prof. Mathias Galetz | DECHEMA
Advancements in Chromium-Silicide Alloy Systems

Prof. Dr.-Ing. Uwe Glatzel | University of Bayreuth
Tensile Creep Behavior of Cr-Si alloys at 980°C
K. Sandner [1], P. Pfizenmaier [1], A.S. Ulrich [1], J. Vogler [1], H. Yen [2], A.C. Yeh [2] (1 University of Bayreuth, 2 National Tsing Hua University)

Jonas Witzgall | University of Bayreuth
Oxide-Scale Development of Cr-rich Cr-Si Based Alloys under Cyclic Oxidation at 1200°C
Mona Ouardi [1], Kan Ma [2], Anke S. Ulrich [1] (1 University of Bayreuth, 2 City University of Hong Kong)

Dr. Emma White | DECHEMA
From A2 + A15 to A2 + B2: Influence of precipitation type on oxidation behavior and mechanical properties of Cr-based alloys in the Cr-Mo-Si+(-NiAl) system
Mathias C. Galetz (DECHEMA)

1710-1800		**Free time**
1800-2030	Atrium	**Poster Exhibition, Drinks Reception and Buffet**

Day 2 - Tuesday 30 June

0830-0900	Atrium	**Registration and Refreshments**
0900-1030		**Session 5: Nuclear Applications for BNBS Systems** Chair: Dr. Matthew Lloyd | University of Manchester
Prof. Dr. Ryuta Kasada | Tohoku University **Microstructural Pathways to Enhanced Damage Tolerance in ODS Alloys for Advanced Nuclear Power Systems** *Hao YU, Diancheng GENG, Zimo GAO, Yuki OGAWA, Toshiki SAITO, Jaeyoon BAE, Feifan HE, Minha PARK, Sosuke KONDO*		
Prof. Adrien Couet | University of Wisconsin-Madison **High Throughput Research of Ordered-Precipitate BCC Compositionally Complex Alloys for Advanced Nuclear Environments**		
Cameron Yousefian | University of Birmingham **Thermal Stability and Phase Transformation Pathway in Zr30-Ti25-Nb25-Al10-Mo5-Ta5 Refractory High Entropy Superalloy** *Kan Ma [1,2], Luke Howard [1], Sang Pham [1], Samuel Humphry-Baker [3], Sarah Day [4], Hannah Wilcox [5], Alexandra Cackett [5], Sandy Knowles [1]* *(1 University of Birmingham, 2 University of Hong Kong, 3 Imperial College London, 4 Diamond Light Source, 5 NNL)*		
Nick Crnkovich | University of Wisconsin-Madison **Irradiation Induced Void Formation in a Light, Refractory BCC-L21 Compositionally Complex AlCoCrMnTIV System** *Abe Burleigh [1], Kavin Ammigan [1], Izabela Szlufarska [2], Adrien Couet [2]* *(1 Fermi National Accelerator Laboratory, 2 University of Wisconsin)*		
1030-1100	Atrium	**Refreshments**
1100-1230		**Session 6: Refractory Metals & Advanced High Temperature Testing** Chair: Prof Uwe Glatzel | University of Bayreuth
Nicholas Sim | Alloyed Ltd. **Next-Generation Niobium Alloys via Additive Manufacturing: Microstructure, Mechanical Properties, and Alloy Design** *Shaumik Lenka (Alloyed Ltd.)*		
Jnr Prof. Benjamin Grégoire | La Rochelle Université **Superior hot corrosion resistance of TaMoCrTiAl refractory high-entropy alloy at 900°C in molten Na2SO4 compared to CMSX-4® single-crystal nickel-based superalloy** *Chongchong Tang [1], Bronislava Gorr [1], Fernando Pedraza [2] (1 Karlsruhe Institute of Technology, 2 La Rochelle Université)*		
Lukas Korell | DECHEMA **Hot corrosion behavior of Mo-based alloys** *Katharina Beck [1], Ceyhun Oskay [1], Gabriely Falcão [2], Martin Heimaier [2], Mathias Galetz [1]* *(1 DECHEMA, 2 Karlsruhe Institute of Technology)*		
Dr. Matthew Lloyd | University of Manchester **Development of High Temperature Tungsten-Alloys for Nuclear Fusion** *Iris Carneiro [1], Muhammad Naeem [1,2], Liliana Romero Resendiz [1,2], Cameron Yousefian [1], Alexander J. Knowles [1]* *(1 University of Birmingham, 2 Liaoning Academy of Materials)*		

1230-1330	Atrium	**Lunch and Poster Exhibition**
1330 onwards		**Free tim**

Some suggestions of attractions in the area include:

- **Black Country Living Museum** (https://bclm.com/) | **DY1 4AL** | Tickets from £28
  Accessible by **taxi** (~30 minutes) or **train** (~90 minutes)
- **Cadbury World/Bournville area** (www.cadburyworld.co.uk) | **B30 1JR** | Tickets from £18
  Accessible by **bus** or **train** (~30 minutes) or **taxi** ~10 minutes)
- **Winterbourne House and Gardens** (www.winterbourne.org.uk) | **B15 2RT** | Tickets from £11
  Accessible by **foot** (~5 minutes)
- **Birmingham Botanical Gardens** (www.birminghambotanicalgardens.ork.uk) | **B15 3TR** |
  Tickets from £10
  Accessible by **foot** (~30 minutes) or **taxi** (~5 minutes)
- **Sea Life Centre** (www.visitsealife.com/birmingham) | **B1 2HL** | Tickets from £26
  Accessible by **bus** or **train** (~30 minutes) or **taxi** ~10 minutes)
- **Midlands Art Centre** (www.macbirmingham.co.uk) | **B12 9QH** | Prices dependent on events
  Accessible by **bus** (~25 minutes), **taxi** (~10 minutes), or **foot** (~35 minutes)
- **Birmingham Museum & Art Gallery** (www.birminghammuseums.org.uk) | **B3 3DH** | Free admission
  Accessible by **bus** or **train** (~30 minutes) or **taxi** (~15 minutes)

Further information about the city of Birmingham and attractions is available at:
Visit Birmingham (https://visitbirmingham.com)
Culture and Collections (https://www.birmingham.ac.uk/university/campus/museums-and-attractions).

Day 3 - Wednesday 1 July

0830-0900	Atrium	**Registration and Refreshments**
0900-1030		**Session 7: Refractory High Entropy Alloys (RHEAs)** Chair: Dr. Kan Ma | City University of Hong Kong

Prof. Eric Lass | University of Tennessee
Refractory compositionally complex alloys with combined high temperature strength and tensile ductility

Julia Chmielewska | EMPA, EPFL
Room Temperature Ductility & Elevated Temperature Strength in Hf–Mo–Nb–Ti Refractory Multi Principal Element Alloys
Tijmen Vermeij (EMPA), Maria Wątroba (EMPA), Fedor Klimashin (EMPA), Christian Leinenbach (EMPA, EPFL)

Dr. Masoumeh Faraji | Coventry University
Sustainable Solid-State Manufacturing of Refractory High-Entropy Alloys for Nuclear Energy Systems: Opportunities and Challenges
Ian Mellor (Metalysis)

Dr. Tamsin Whitfield | University of Oxford
Advanced tungsten alloys: A challenge of stability under extreme conditions
Andrey Litnovsky [1], Jie Chen [1], Eric Prestat [2], Duc Nguyen-Manh [2], Mark Gilbert [2], Alya Musa [3]
(1 Forschungszentrum Jülich GmbH, 2 UKAEA, 3 University of Oxford)

1030-1100	Atrium	**Refreshments**
1100-1230		**Session 8: Vanadium-based Silicide Developments** **Chair: Prof. Sebastian Kube | University of Wisconsin-Madison**

Roja Rani Korrayi | Helmholtz-Zentrum Hereon
Microstructure formation of eutectic V-9Si-6.5B alloys observed by in-situ HE-XRD during directional solidification
Zahra Sabeti [1], Florian Pyczak [2], Andreas Stark [2], Georg Hasemann [1], Manja Krüger [1]
(1 Otto-von-Guericke University Magdeburg, 2 Helmholtz-Zentrum Hereon)

Dr. Georg Hasemann | Otto-von-Guericke University Magdeburg
Assessment of the Isothermal Section in the V-Rich V–Si–B System at 1400 °C
Weiguang Yang [1], Mustafa Carrion Saldaña [2], Bronislava Gorr [3], Ruth Schwaiger [1], Manja Krüger [4]
(1 Forschungszentrum Jülich GmbH, 2 University Siegen, 3 KIT, 4 Otto-von-Guericke University Magdeburg)

Zahra Sabeti | Otto-von-Guericke University Magdeburg
High-Temperature Compressive Behaviour of Directionally Solidified V–9Si–6.5B Eutectic Alloy
Roja Rani Korrayi [1], Andreas Stark [1], Florian Pyczak [1], Manja Krüger [2], Georg Hasemann [2]
(1 Helmholtz-Zentrum Geesthacht, 2 Otto-von-Guericke University Magdeburg)

Liu Yang | Karlsruhe Institute of Technology (KIT)
Microstructural Stability of Re and Ru Modified A2 + B2 Refractory High Entropy Alloys
Sandipan Sen 1, Vikram Raja Jothi [1], Marcel Münch [2], Christoph Somsen [2], Yolita M. Eggeler [1], Daniel Schliephake [1], Martin Heilmaier [1], Alexander Kauffmann [2]
(1 Karlsruhe Institute of Technology, 2 Ruhr University Bochum)

1230-1330	Atrium	**Lunch**
1330-1500		**Session 9: Modelling Approaches to Enable BNBS Materials** Chair: Prof. An-Chou Yeh | National Tsing Hua University
Dr. Ida Berglund | Thermo-Calc Solutions **Turning alloy concepts into hardware: CALPHAD in action** *John Aristeidakis, Fuyao Yan (Thermo-Calc Solutions)*		
Dr. Theresa Davey | Bangor University **Designing complex microstructures using first-principles-only CALPHAD**		
Prof. Sebastian Kube | University of Wisconsin-Madison **Navigating the multidimensional refractory alloy design space by integrating autonomous experiments, computation, and AI**		
Dr. Vincent Gagneur | University of Birmingham **Rapid analysis of slip traces for the early-stage mechanical screening of bcc and ordered-bcc compounds** *Alexander Knowles (University of Birmingham)*		
1500-1530	Atrium	**Refreshments**
1530-1700		**Panel Discussion** **Session 10: Next-Generation FCC & TiAl Systems** Dr. Ed Pickering | University of Manchester
PANEL DISCUSSION		
Prof. An-Chou Yeh | National Tsing Hua University **Grain-Boundary Engineering and Elevated-Temperature Properties of LPBF-Compatible $L1_2$-Strengthened High-Entropy Alloys**		
Dr. Christopher Zenk | Friedrich-Alexander-Universität **Microstructure Evolution and Mechanical Properties of Ferritic Superalloys** *Luis Morales, Kai Eberl, Andreas Bezold, Ashton Egan, Steffen Neumeier (Friedrich-Alexander-Universität)*		
Manashi Sabat | Indian Institute of Technology **Mechanical response and microstructural evolution of an oxide dispersion strengthened Ni-rich high entropy alloy during high-temperature deformation** *Sudhansu Maharana, Tapas Laha (Indian Institute of Technology)*		
Sarra Boubtane ep Zammouri | German Aerospace Center **MAX-Phase Coatings for Protecting TiAl Alloys in High-Temperature Water Vapor Environments** *Nadine Laska [1], Ronja Anton [1], Radosław Swadźba [2]* *(1 German Aerospace Center, 2 Upper Silesian Institute of Technology)*		
1710-1800		**Free time**
1800-2300	Edgbaston Park Hotel	**Reception Drinks and Conference Dinner**

Day 4 - Thursday 2 July

0830-0900	Atrium	**Registration and Refreshments**
0900-1030		**Session 11: Bcc-Superalloys (2)** Chair: Prof. Kyosuke Yoshimi | Tohoku University
Prof. Alexander Knowles | University of Birmingham **Bcc-superalloys a microstructure template for nuclear, aerospace and thermal solar**		
Dr. Vikram Raja Jothi | Karlsruhe Institute of Technology (KIT) **Ultra-slow coarsening in precipitation-strengthened refractory high-entropy alloys** *Sandipan Sen [1], Liu Yang [1], Michael K. Eusterholz [1], Amin Radi [1], Daniel Schliephake [1], Jean-Philippe Couzinié [2], Alexander Kauffmann [3], Martin Heilmaier [1]* *(1 Karlsruhe Institute of Technology, 2 Université Paris, 3 Ruhr University Bochum)*		
Dr. Alex Carruthers | UKAEA **Development of (relatively) low cost and low density Refractory-Ruthenium based superalloys (RRSs)** *Ed Pickering*		
Dr. Ievgen Solodkyi | Otto-von-Guericke University Magdeburg **Microstructure engineering for ductility enhancement of a lightweight $Fe_{32}Cu_{12}Ni_{11}Ti_{16}Al_{29}$ alloy via powder metallurgy** *Rostyslav Nizinkovskyi [1], Sergii Teslia [2], Iurii Bogomol [2], Manja Krüger [1]* *(1 Otto-von-Guericke University Magdeburg, 2 National Technical University of Ukraine)*		
1030-1100	Atrium	**Refreshments**
1100-1230		**Session 12: New Approaches for Silicide Systems** Prof. Manja Krueger | Otto-von-Guericke University Magdeburg
Prof. Kyosuke Yoshimi | Tohoku University **Microstructure-Dependent Crack Propagation Behavior in MoSiBTiC Alloy Analyzed by the Extended Finite Element Method** *Junfeng Du, Takahiro Kaneko (Tohoku University)*		
Prof. Panos Tsakiropoulos | University of Sheffield **Ultra-High-Temperature-Materials for HPT Blades for Aeroengines: Directional Solidification and Design Issues**		
Matthew Gelmetti | University of Sheffield **Use of Field Assisted Sintering Technology (FAST) for the manufacture of a metallic high temperature materials system**		
Dr.-Ing. Daniel Schliephake | Karlsruhe Institute for Technology (KIT) **The Influence of Processing Techniques on the Creep Behavior of Eutectic Mo-Si-Ti Alloys** *Alexander Kauffmann (Ruhr University Bochum), Martin Heilmaier (Karlsruhe Institute for Technology)*		
1230-1300		**Closing Remarks and Prizes**
1300-1400	Atrium	**Lunch**
1430		**Close**

Delegate List

Dr. Eng. Taichi Abe | National Institute for Materials Science (NIMS)

Ida Berglund | Thermo-Calc Solutions

Sarra Boubtane | German Aerospace Center

Dr. Iris Carneiro | University Of Birmingham

Dr. Alex Carruthers | UK Atomic Energy Authority

Julia Chmielewska | EMPA

Prof. Katerina Christofidou | University Of Sheffield

Dr. Isadora Costa | CBMM - Niobium

Prof. Adrien Couet | University Of Wisconsin - Madison

Nick Crnkovich | University Of Wisconsin - Madison

Jason Crookes | Siemens Energy

Tessa Davey | Bangor University

Dr. Timo Depka | Siemens Energy

Prof. Hongbiao Dong | University Of Birmingham

Dr. Masoumeh Faraji | Coventry University

Dr. Carolina Frey | ATI

Dr. Vincent Gagneur | University Of Birmingham

Assoc. Prof. Mathias Galetz | DFI DECHEMA Research Institute

Matthew Gelmetti | University Of Sheffield

Prof. Dr.-ing. Uwe Glatzel | University Of Bayreuth

Dr. Benjamin Gregoire | La Rochelle University

Julie Hammoud | TU Darmstadt

Dr. Georg Hasemann | Otto-von-Guericke University Magdeburg

Kathy Ho | Lawrence Livermore National Laboratory

Josh Hobbins | Bangor University

Luke Howard | University Of Birmingham

Dr. Ryuta Kasada | Tohoku University

Prof. Dr.-Ing. Alexander Kauffmann | Ruhr-University Bochum

Dr. Kateryna Khanchych | Karlsruhe Institute of Technology

Prof. Alexander Knowles | University Of Birmingham

Lukas Korell | Dechema Research Institute

Roja Rani Korrayi | Helmholtz-Zentrum Hereon

Prof. Manja Krueger | Otto-von-Guericke University Magdeburg

Prof. Sebastian Kube | University Of Wisconsin - Madison

Chihana Kudo | Tohoku University

Eric Lass | University Of Tennessee Knoxville

Dr. Shaumik Lenka | Alloyed Ltd

Dr. Matthew Lloyd | University Of Manchester

Dr. Kan Ma | City University Of Hong Kong

Sudhansu Maharana | Indian Institute of Technology Kharagpur

Hiromu Matsuura | Tohoku University

Naoyuki Nomura | Tohoku University

Dr. Ed Pickering | University Of Manchester

Florian Pyczak | Helmholtz-zentrum Hereon

Amin Radi | Karlsruhe Institute Of Technology

Noel Raison | University of Birmingham

Dr. Vikram Raja Jothi | Karlsruhe Institute of Technology

Toni Renz | University Of Oxford

Manashi Sabat | Indian Institute of Technology Kharagpurv

Zahra Sabeti | Otto-von-Guericke University Magdeburg

Daniel Schliephake | Karlsruhe Institute of Technology

Dr. Puyu Shi | University Of Birmingham

Nicholas Sim | Alloyed Ltd

Dr. Ievgen Solodkyi | Otto-von-Guericke- Universität Magdeburg

Prof. Howard Stone | University Of Cambridge

Dr. Patricia Suárez Ocaño | Siemens Energy

Ethan Sumner | University Of Birmingham

Dr. Yuanbo Tang | University of Birmingham

Colin Teoh | University Of Oxford

Lars Thielemann | Otto-von-Guericke-University Magdeburg

Prof. Panos Tsakiropoulos | The University Of Sheffield

Dr. Nihan Tuncer | Foundations Alloy Explorations

Jan Vollhüter | FAU Erlangen-Nürnberg

Dr. Nils Warnken | University Of Birmingham

Dr. Emma White | DECHEMA Research Institute

Dr. Tamsin Whitfield | University Of Oxford

Jonas Witzgall | University of Bayreuth

Pelle Wolf | DECHEMA Research Institute

Deepan Xavier | Coventry University

Dr. Nataliya Yadzhak | University of Bayreuth

Liu Yang | Karlsruhe Institute of Technology

Prof. An-chou Yeh | National Tsing Hua University

Prof. Kyosuke Yoshimi | Tohoku University

Cameron Yousefian | University Of Birmingham

Dr. Christopher Zenk | Bayern Innovativ Gmbh

Dawei Zhou | Chalmers University Of Technology

Dr. Lu Zhu | Chalmers University Of Technology

MATERIALS FOR EXTREMES

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