

UNIVERSITÄT
BAYREUTH



Kick-Off

2nd Phase

DFG – SPP "CCA – HEA"

Uwe Glatzel

Metals and Alloys, University of Bayreuth





1st Period: Overview



First funding period

- ~ 7.4 mill. € for
- ~ 25 PhD/post-
- 14 projects pos
- 10-15 addition
- funding from c

⇒ ~ 100 material



2nd Period: Very similar funding situation

post-doc each) with

interactive map on www.sppcahea.de



Internationalization



Three (!) SPP CCA - HEA comparable funding started in Asia:

- 05/2016: Prof. Hyoung Seop Kim, Pohang University of Science and Technology, **South Korea**: 6.6 mill. € for 6 years
- 01/2018: Prof. Jien-Wei Yeh, NTHU, **Taiwan**: High Entropy Materials Center (HEMC): 9.1 mill. € for 5 years
- 04/2018: Prof. Haruyuki Inui, Kyoto University, **Japan**: 13.2 mill. € for 5 years

in comparison SPP2006: ~ 14 mill. € for 6 years





Internationalization



- PhD/post-docs going outside Germany (SPP-funded):
 - **Sonun Ulan kyzy**, University of Bayreuth → Ohio State University, USA:
“SEM-ECCI work to determine local dislocation densities“
 - **Daniel Utt**, TU Darmstadt → Ohio State University, USA:
“Simulation of dislocations in HEA via DFT“
 - **Korbinian Deck**, KIT → University of Melbourne, Australia:
“Dislocation properties of bcc High Entropy Alloys“
 - **Stephan Bantscheff**, University of Bayreuth → NTHU, Taiwan:
“Zone melting techniques to process bcc HEA with large grain sizes“
 - **Markus Holzinger**, University of Bayreuth → Northwestern University, USA:
“Sharp interface phase field modelling“
 - **Felix Schleifer**, University of Bayreuth → ONERA, Paris





Organization of CCA - HEA Sessions in International Conferences



- EUROMAT 2017, Thessaloniki, Greece
- MSE 2018, Darmstadt, Germany
- DPG Spring Meeting 2019, Regensburg, Germany
- EUROMAT 2019, Stockholm, Sweden
- MRS Fall Meeting 2020, Boston, USA
- Series of International Conference on High Entropy Materials (ICHEM):
 - 2016: Hsinchu, Taiwan, organized by Prof. Jien-Wei Yeh
 - 2018: Jeju Island, South Korea, organized by Prof. Hyoung Seop Kim
 - 2020: Berlin, Germany, organized by SPP CCA – HEA
 - 2022: Knoxville, TN, USA

virtuell

face-to-face





SPP Networking



| | Event | Date | Location | Organizer | Attendees |
|----------|---|-----------------------|------------------|--|-----------|
| 1 | First “big“ meeting | 14.-15.02.2018 | Hannover | Maier, H.J. | 79 |
| 2 | Project Group „Modeling & Simulation“ | 11.10.2018 | Aachen | Noori, M. | 9 |
| 3 | Project Group „Processing“ | 09.10.2018 | Jülich | Lienig, T. | 7 |
| 4 | Project Group „CCA – mech. properties“ | 18.09.2018 | Bayreuth | Haas, S. | 10 |
| 5 | Project Group „HEA – mech.properties“ | 08.-09.11.2018 | Dresden | Thiel, F. | 26 |
| 6 | Second “big” meeting | 25.-27.03.2019 | Karlsruhe | Heilmaier, M. Kauffmann, A. | 75 |
| 7 | Project Group „Synthesis & Processing“ | 29.08.2019 | Bochum | Piorunek, D. | 12 |
| 8 | Project Group „High throughput methods“ | 13.09.2019 | Bochum | Laplanche, G. | 10 |
| 9 | Project Group „Diffusion“ | 16.09.2019 | Münster | Kottke, J. | 10 |
| 10 | Project Group „HEA – mech.properties“ | 23.-24.09.2019 | Darmstadt | Keil, T. | 22 |
| 11 | Workshop on large scale facility-based techniques | 26.-27.09.19 | Berlin | Fantin, A. | 15 |
| 12 | Project Group „CCA – mech.properties“ | 23.10.2019 | Aachen | Kies, F. | 9 |
| 13 | ICHEM2020 | 27.09 – 01.10.2020 | Berlin | SPP Coordination | 60 |



SPP Networking: First “big“ meeting in Hannover



- 79 participants (principal investigators, post-docs, PhD-students)
- Organization: Prof. Dr.-Ing. Hans-Jürgen Maier
- Establishing four subgroups





SPP Networking: Second “big“ meeting in Karlsruhe



- 75 participants (two invited international scientists: Mike Mills + Easo George)
- Prof. M. Heilmaier, Dr.-Ing. A. Kauffmann, KIT
- **Only selected talks**, poster sessions and fruitful panel discussion

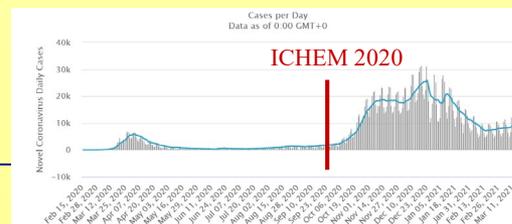




ICHEM 2020



- 60 participants (43 Germany, 9 French)
- Sunday evening – Thursday noon (27.09. – 01.10.20)
- Two social events





SPP Networking



> 80 papers in international peer-reviewed journals published.

<http://www.sppccahea.uni-bayreuth.de/en/publications>

Most of them as collaborative work within SPP CCA - HEA.





SPP Meetings:



Generally (before Corona times):

- one big meeting per year
 - 2021: this kick-off meeting
 - 2022: in presence, in Bayreuth, ~ April/May
 - 2023: somewher in Germany
- several focus oriented smaller meeting per year (every SPP project at least in one subgroup)
- everybody who is interested is welcome to participate!
- English language mandatory



Zoom Meeting Rules:



- You can test and, if necessary, adjust your audio and video settings in advance using Settings (gear symbol at the top right) in the zoom client.
- When you enter the meeting room, you are **initially muted**. At the bottom left you can unmute yourself and start your video. For a short audio comment, you can press the space bar (unmuted as long as you press it).
- For your presentation, select the screen sharing at the bottom center and select the correct screen in which the presentation is displayed.



Kick-Off 2nd Phase



| | 13 April 2021, Tuesday | | | 14 April 2021, Wednesday | | |
|---------------|------------------------------|--------------|--|--------------------------|--------------|--|
| Time slot | Speaker | Institute | Short Title | Speaker | Institute | Chair : Sebastian Haas |
| 10:00 - 10:15 | Chair : Uwe Glatzel | | | Noori, Mehdi | RWTH Aachen | Thermodynamic modelling in HEAs |
| 10:15 - 10:30 | Glatzel, Uwe | Uni Bayreuth | Introduction, some remarks and smalltalk | Haase, Christian | RWTH Aachen | Mechanism-oriented design of CCAs |
| 10:30 - 10:45 | Gärtner, Eric | IWT Bremen | Synthesis of particle-reinforced CCA produced by additive manufacturing | Laube, Stephan | KIT | Development of refractory complex concentrated alloys for high-temperature applications |
| 10:45 - 11:00 | Jäggle, Eric | Uni Bw M | Fracture toughness, fatigue, and hydrogen resistance of additively manufactured p-CCAs | Schellert, Steven | KIT | High temperature oxidation behavior of Ta-Mo-Cr-Ti-Al RHEA with different Ta concentrations |
| 11:00 - 11:15 | Körmann, Fritz | MPIE | Stability and interstitial doping in high-entropy alloys from ab initio | Gärtner, Daniel | Uni Münster | Tracer diffusion in single crystalline CoCrFeNi and CoCrFeMnNi HEA |
| 11:15 - 11:30 | Ma, Yan | MPIE | Interstitial doping in high-entropy alloys | Sen, Sandipan | Uni Münster | Solute and self-diffusion in Hexagonally Close Packed (HCP) HEAs |
| 11:30 - 11:45 | Kottke, Josua | Uni Münster | Diffusion in Ni-HEAs | Gemagami, Parham | RU Bochum | Phase stability, precipitation kinetics, nanoscale elemental distributions and their effect on tensile properties in refractory TiZrNbHfTa BCC HEA |
| 11:45 - 12:00 | Taherinija, Shabnam | Uni Münster | Studying the structural evolution of nanocomposite HEAs after irradiation | Zhao & Li | RU Bochum | |
| 12:00 - 13:00 | Chair : Christian Gadelmeier | | | Chair : Laura Rosenkranz | | |
| | | | Lunch Break | | | Lunch Break |
| 13:15 - 13:30 | Keil, Tom | TU Darmstadt | Structure, solid solution hardening and deformation mechanisms of bcc HEAs using diffusion couples | Deck, Korbinian | KIT | Intrinsic deformation mechanisms in BCC HEA |
| 13:30 - 13:45 | Nag, Shankha | TU Darmstadt | Grain boundary phases and mobility in elements and complex concentrated alloys | Suarez Ocano, Patricia | BAM Berlin | Microstructural properties of AlMo _{0.5} NbTa _{0.5} TiZr refractory CCA |
| 13:45 - 14:00 | Oluwabi, Oluwaseyi | RU Bochum | Alloy Chemistry, Alloy Development, Microstructures and Martensitic Transformations | Drescher, Sophie | IFW Dresden | The analysis of the strengthening mechanisms in single-phase high-entropy alloys |
| 14:00 - 14:15 | Hinte, Christian | Uni Hannover | Quinary and Senary High Entropy Shape Memory Alloys: Extrusion, Functionality, Degradation | Tirunilai, Aditya | KIT | Discontinuous Deformation of FCC High and Medium Entropy Alloys at Close to 0 K |
| 14:15 - 14:45 | Coffee Break | | | Coffee Break | | |
| 14:45 - 15:00 | Haas, Sebastian | Uni Bayreuth | Refractory metals improving the mechanical properties of Al ₁₀ Co ₂₅ Cr ₈ Fe ₁₅ Ni ₃₆ Ti ₆ | Schneider, Mike | RU Bochum | Temperature dependence of mechanical properties and deformation mechanisms in an CrFeNi MEA |
| 15:00 - 15:15 | Bezold & Neumeier | FAU Erlangen | Polycrystalline High Entropy Superalloys (PHESA) | Gadelmeier, Christian | Uni Bayreuth | Strengthening mechanisms of CrCoNi and CrMnFeCoNi at creep temperatures above 700°C |
| 15:15 - 15:30 | Wolff-Goodrich, Silas | MPIE | Microstructure Formation and High Temperature Mechanical Properties of Al ₂₀ Cr ₂₀ Fe ₃₅ Ni ₂₀ Ti ₅ | | | |
| 15:30 - 15:45 | Zhang, Jingfeng | Uni Münster | Diffusion in sigma phase of the CoCrFeMnNi system | Glatzel, Uwe | Uni Bayreuth | Picture show of ICHEM 2020 in Berlin and closing remarks |
| 15:45 - 16:00 | Lukianova, Olga | Uni Münster | Impact of carbon on diffusion in CoCrFeMnNi | | | |