



High-throughput experimental and Calphad screening of CCAs (Hi-TeCC) – towards new alloys with exceptional mechanical properties

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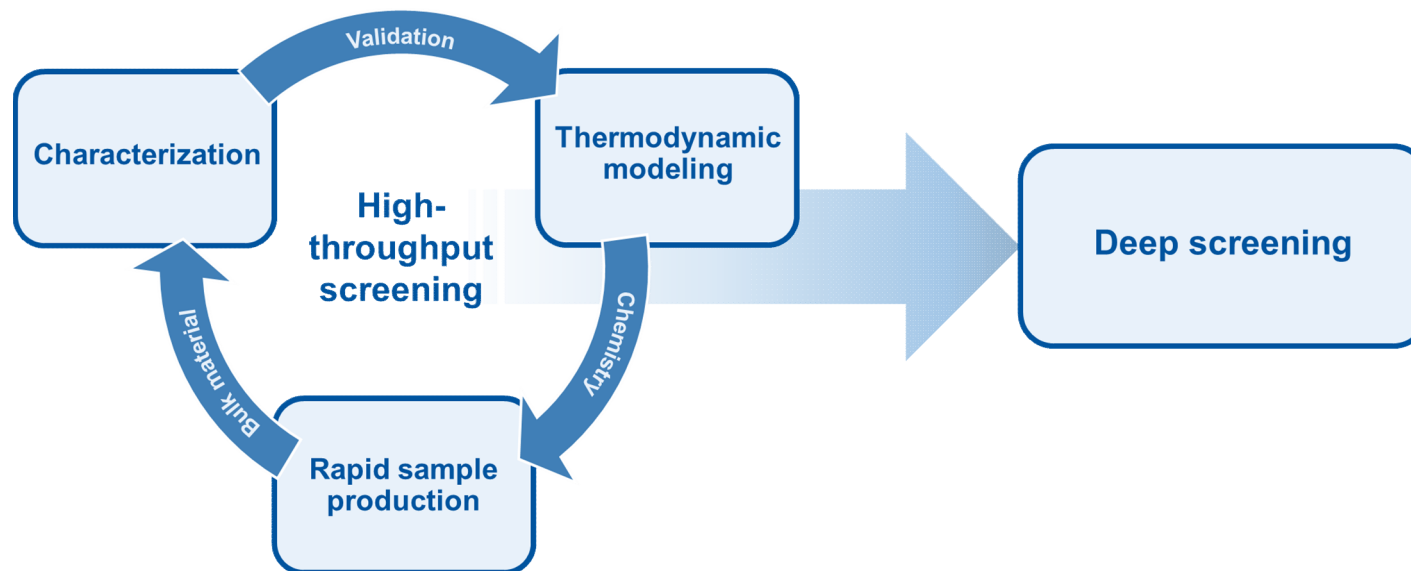
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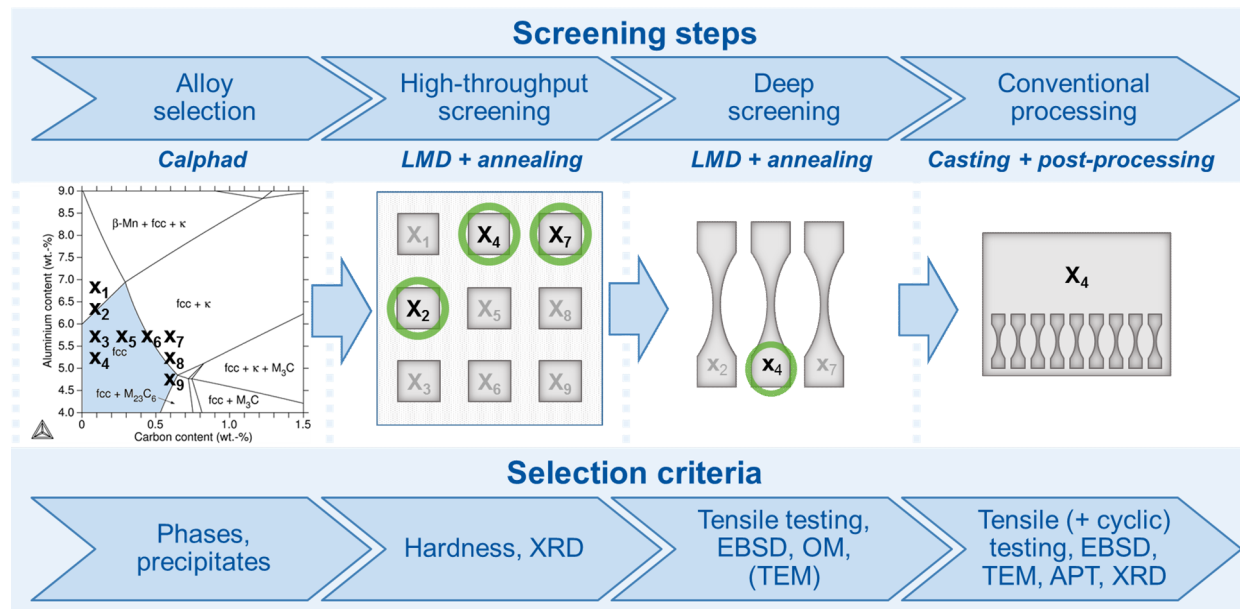
Branch: CCA

Begutachtungskolloquium SPP CCA-HEA, Bayreuth, 04.04.2017

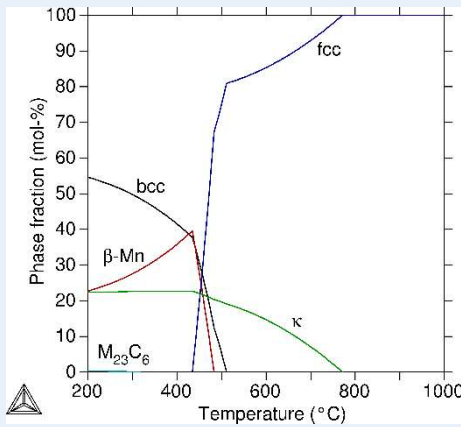
- improving mechanical properties by advancing from HEAs to CCAs
 - fcc => fcc + phase1 + phase2 + ...
- promising alloys can only be identified and developed using reliable thermodynamic predictions => so far there is no database for HEAs/CCAs
- high-throughput screening approach including simulations and experiments is needed to explore new CCAs => so far there is no methodology



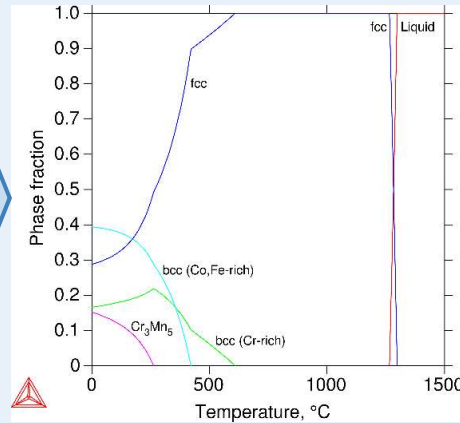
- microstructure design of fcc-based CCAs in the Al-Co-Cr-Fe-Mn-Ni-C system
 - develop new alloys with high strength and ductility
- development of a thermodynamic database
- Calphad prediction of precipitates (e.g. B2, κ) and phase stabilities
- new methodology for screening of CCAs: combination of Calphad calculations and rapid bulk material production by LMD



Calphad modeling



Fe-Mn-Al-C



Al-Co-Cr-Fe-Mn-Ni-C



Sample production



LMD

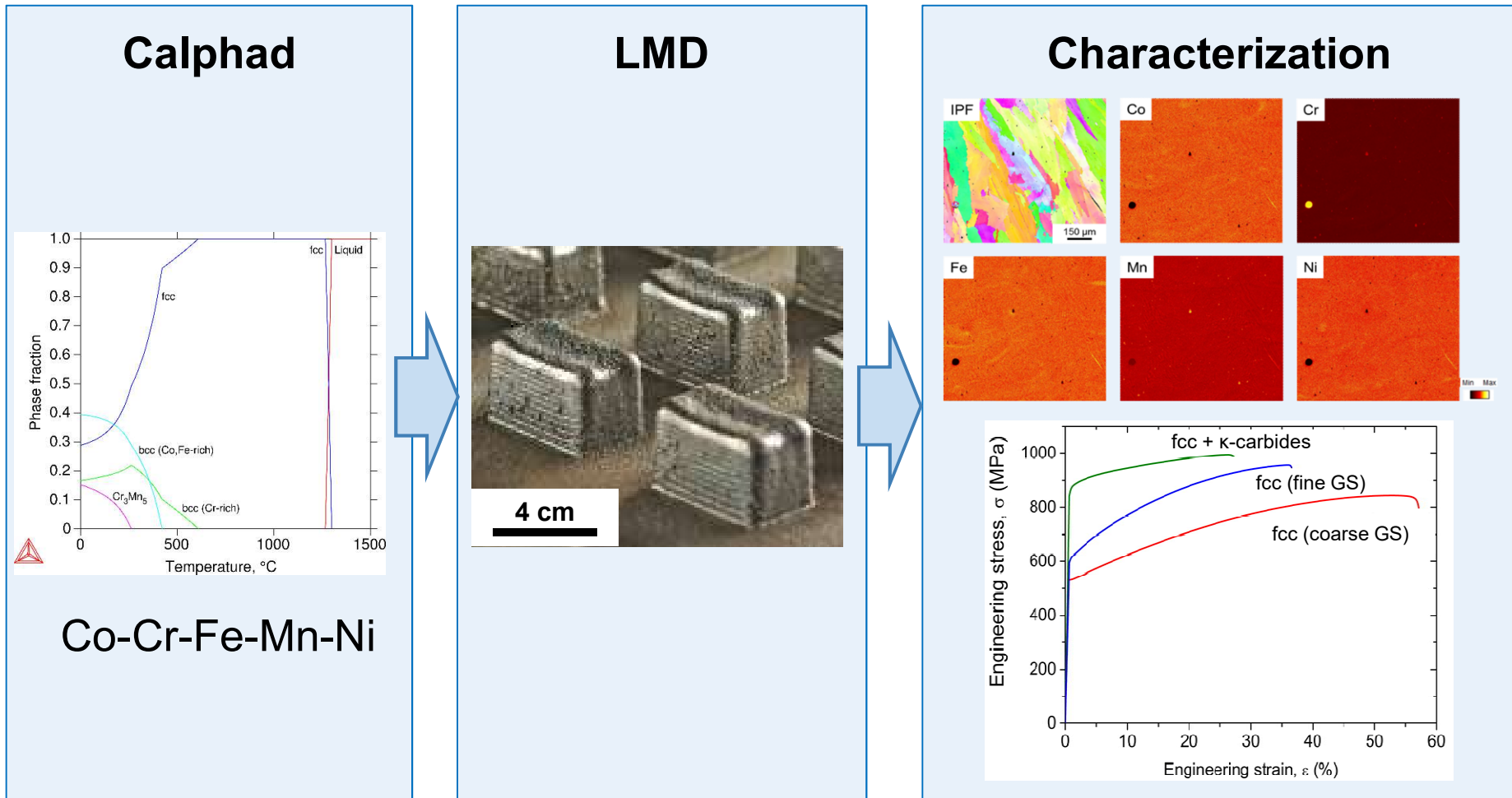


Casting

[Hallstedt B, Khvan AV, Lindahl BB, Selleby M, Liu S. *Calphad* 2017;56:49.]

[Haase C, Tang F, Wilms MB, Weisheit A, Hallstedt B. *Mater. Sci. Eng. A* 2017;688:180.]

[Haase C, Zehnder C, Ingendahl T, Bikar A, Tang F, Hallstedt B, Hu W, Bleck W, Molodov DA. *Acta Mater.* 2017;122:332.]

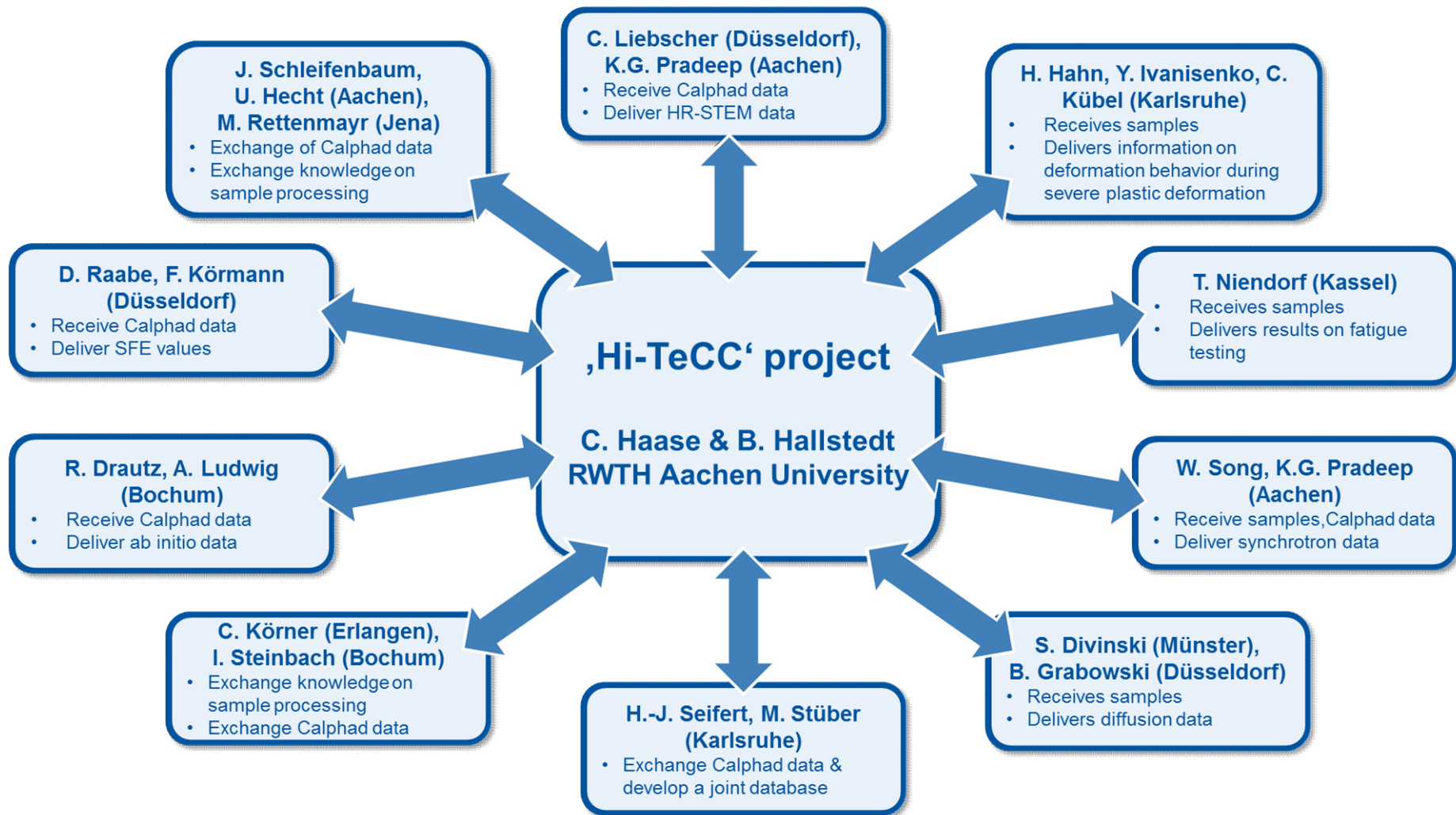


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- enable thermodynamic description of HEAs and CCAs, development of a database that will be accessible for the entire SPP
 - explore a high number of CCAs to find alloys with improved mechanical properties
 - understand the influence of chemistry and microstructure on the mechanical properties
 - extensive microstructure characterization
 - deformation behavior will be investigated on bulk tensile specimens under static and cyclic loading conditions at RT and elevated T
- => application-oriented assessment of design criteria for new advanced structural materials based on the concepts of HEAs



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Thank you very much for your attention!