Strength and deformation of precious high entropy alloys

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The present proposal aims at a sound description of the structure-property relationships in AuCuNiPdPt. The results will be used to separate the material behaviour of the HEAs cleanly from that of single phase conventional alloys and to identify which issues are special for HEAs leading to their peculiar properties. This would help engineers to understand, control and tune the properties of HEAs more efficiently.
Motivation and aims

Investigation of single phase high entropy alloys

• cleanly separate the material behaviour of HEAs from that of single phase conventional alloys
• identify which issues are special for HEAs leading to their peculiar properties
• influence of single or multiple element concentration on strength
• deformation mechanisms
• the gained knowledge can be transferred and applied to CCAs
• however, a basic understanding of the underlying effects on materials properties can be gained with higher soundness from single phase HEAs

contributions to the scientific aims of SPP 2006 CCA-HEA
Preliminary work

The Au-Cu-Ni-Pd-Pt system

- discovery of a new single phase HEA
- sample preparation by arc-melting and / or mould casting
- homogeneous solid solution in the whole (?) concentration range
- cold working by swaging and rolling, ...
Aims and work programme

- sample preparation of face centred cubic multi-component homogeneous solid solutions: equimolar AuCuNiPdPt and non-equimolar alloys in this system
- phase stability
- deformation mechanisms including the conditions under which twinning occurs
- strengthening mechanisms solid solution strengthening, strengthening by segregations, grain-boundary strengthening
- outlook for the 2nd period: creep, ...
Networking

Christian Greiner (KIT)
Martin Heilmann (KIT)

↔ mechanical response
→ cold working of CoCrFeMnNi and HfNbTaTiZr

Jens Freudenberger (IFW)

↔ mechanical response
↔ deformation mechanisms
↔ deformation under cryogenic conditions
↔ solid solution strengthening

↔ ufg materials and spd processing
→ HPT of AuCuNiPdPt
← preparation of samples for diffusion couples

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