Strength and deformation of precious high entropy alloys

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. The proposal aims at alloys with a well-defined microstructure that allows to solely investigate issues such as solid solution and grain boundary hardening. For this purpose the initial single phase microstructure is the decisive factor for a sound description of the properties. The Au-Cu-Ni-Pd-Pt system is the only known system that allows to investigate effects of compositional changes, presumably in the whole range, without the necessity to also consider the occurrence of structural changes of secondary phases. A key issue of the present proposal is to investigate the deformation mechanisms in the alloys at room temperature and under cryogenic conditions, which presumably shows a change from dislocation glide to twinning when lowering the temperature. The mechanical properties of the alloys are affected by e.g. severe lattice distortions, which presumably cause retarded dislocation-, grain- and twin boundary movements as well as decelerated kinetics of recovery and recrystallization. These relationships will be clarified. The proposal addresses questions on the nature of solid solution strengthening in multicomponent alloys, the effect of segregations on the strength of metallic materials and on the variation of strength with decreasing grain size. This seemingly simple questions appears in order to separate the extraordinary materials properties observed for HEAs from that of conventional alloys and to provide a suitable description of the behaviour.