Institute of Materials Science, Joining and Forming
Kopernikusgasse 24/I, 8010 Graz

Announcement of a Master's thesis, 26.01.2024

Characterisation of additively manufactured Ti-Al-based high-entropy alloys

Description

The concept of high-entropy alloys (HEAs) is attracting increasing interest, since it opens the way to a variety of new materials with potentially surprising properties. In this Master's thesis, the Ti-Al-Nb-Mo-Cr system will be investigated. Besides its promising high-temperature properties, which originate from the relatively high content of refractory metals, this system offers the possibility of adjusting the order of the matrix phase depending on the Al content. This order, in turn, is considered to play an important role for the mechanical and further high-temperature properties, such as oxidation. Yet, HEAs, and especially those based on refractory metals (= RHEAs), are difficult to fabricate and characterise, since they tend to segregate strongly upon casting. In this regard, the potential of laser powder-bed fusion (LPBF), an additive manufacturing (AM) technique available at IMAT, shall be explored for the creation of fine-grained, homogeneous bulk material. In-situ alloying will be used to create specimens of varied chemical compositions from a mixture of elemental powder. The achieved degree of homogeneity in the as-printed specimens shall be probed down to the microscopic level in the framework of this Master's thesis.

Activities

1. Literature research on (R)HEAs, with a particular focus on AM / in-situ alloying
2. Characterisation of HEA specimens prepared by means of LPBF (various printing parameter combinations and differing chemical compositions) in terms of:
    a. Density
    b. Homogeneity (Light-optical and scanning electron microscopy *incl.* EDS, X-ray fluorescence, (micro-)hardness maps)
    c. Phase composition (Electron backscatter diffraction, (synchrotron) X-ray diffraction)
    d. Phase transformation/ordering behaviour (Differential scanning calorimetry)
3. Documentation, preparation of the Master's thesis (English or German) and a publication (article/poster)

Organisation

Supervisor: Ass.Prof. Dipl.-Ing. Dr.mont. Petra Spörk-Erdely, petra.spoerk-erdely@tugraz.at.
Duration: min. 6 months, start as of now
Location: IMAT, Materials Group, Kopernikusgasse 24/I, 8010 Graz
Funding: Employment as a project assistant at IMAT ("geringfügige Anstellung")
Requirements: Basic knowledge in materials science (Master programmes Advanced Materials Science, (Technical) Physics, (Technical) Chemistry, or Mechanical Engineering)

Further information

For further information, please contact the secretariat of the institute or the supervisor:
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