



Topics of dissertations

Collaborating faculty: **Strojnícka fakulta STU**
Academy year: **2021/2022**
Study field: **36 Engineering**
Study programme: **Engineering technologies and materials**
Length of study: **3 years**

Topic 1: **Concentrated solar power in powder metallurgy of titanium and Ti composites**

Supervisor: **Ing. Jaroslav Kováčik, PhD.** (jaroslav.kovacik@savba.sk)

The aim of PhD work is to use concentrated solar power in Ti powder metallurgy for compaction of titanium powders and its composites. At present, the institute is adapting a device using a Fresnel lens for the concentration of solar energy with an area of 1.5 m², which will be used during this PhD work. The influence of solar radiation, achieved sintering temperatures and compaction time on the resulting microstructure and mechanical and physical properties of prepared Ti-based materials will be investigated. Suitable materials will be selected during the 1st year of study. The experiments will take place in a protective atmosphere. The surface treatment of titanium in a nitrogen atmosphere in order to obtain hard wear resistant TiN layer will be also tested via using of concentrated solar power.

The structure and composition of the prepared Ti materials and treated Ti surfaces will be investigated by scanning electron microscopy, and, if necessary, by transmission electron microscopy. The influence of technological parameters on the mechanical and thermophysical properties of Ti and Ti composites will be also monitored. The scientific result of the work will be a map of the influence of technology parameters on the resulting properties of the prepared Ti materials. The work will be scientifically unique, brand new and original in the world. Knowledge of English language is required.

Topic 2: **Influence of hydrogen on deformation behavior and fracture of complex concentrated alloys**

Supervisor: **Ing. Juraj Lapin, DrSc.** (juraj.lapin@savba.sk)

Hydrogen is a key priority of the European strategy for clean energy and metallic materials are a key pillar of expected technical solutions and innovations in its production, storage, distribution and end-use. PhD thesis will be focused on investigating the influence of hydrogen on the deformation behaviour and fracture of Co-Cr-Fe-Ni type complex concentrated alloys (CCA). The PhD student will participate in the metallurgical preparation of alloys with the required chemical composition, characterization of their microstructure and investigation of the effect of hydrogen on their deformation behaviour at room and low temperatures. He/she will investigate the deformation behaviour of CCA during tensile, compressive, fracture toughness and impact fracture toughness tests. Using the finite element method and the ANSYS program, he/she will simulate the deformation behaviour of the investigated CCAs, determine the critical local stresses and critical local deformations needed for crack initiation and propagation. Numerical

calculations will be verified experimentally. The candidate is required to have experimental skills, knowledge of applied mechanics, basic knowledge of materials science, knowledge of mechanical testing of materials, knowledge of numerical calculation methods as well as a good knowledge of English.