Title: Investigation of hydrogen interactions with defects in high entropy alloys

Author: Bc. Matej Jakubik

Department: Department of Low-Temperature Physics

Supervisor: RNDr. Petr Hruška, Ph.D., Department of Low-Temperature Physics

Abstract: The subject of this master thesis was studying hydrogen absorption and desorption properties of high entropy alloys based on Hf-Nb-Ta-Ti-V-Zr refractory system. High entropy alloys are fairly new points of interest for science and possess unique properties compared to typical alloys. High entropy alloys are generally based on 4 - 6 elements with concentrations of 5 - 35 at%, unlike conventional alloys, which contain 1 major element. Studied alloys have been chosen with different number of elements and different compositions, both equimolar and non-equimolar, varying from Hf-Nb-Ta-Ti-V-Zr system. Hydrogen absorption properties depend strongly on microstructure of samples, which has been studied using modern technologies (positron annihilation spectroscopy, scanning electron microscope and X-ray diffraction). Using these methods phase transformation from metal to hydride and subsequent phase transformation-induced changes of morphology and crystal structure were characterized. Heat induced-desorption of hydrogen was studied using differential scanning calorimetry coupled with residual gas analysis and X-ray diffraction. Various chemical compositions and microstructures have significant impact on hydrogen absorption properties.

Keywords: high entropy alloys, hydrogen loading, positron annihilation spectroscopy