DESCRIPTION FOR THE GENERAL PUBLIC

Increasing emission of greenhouse gases and continuous climate change is currently of prime interest and provokes radical boost of green technologies focused on reduction of energy consumption. Such approach can be met in all types of transport sectors, especially in automotive and aircraft branch where design of new, fuel efficient engines and lightweight constructions are crucial. Regarding to the latter issue, available reports indicate 6 - 8 % decrease in fuel consumption for a 10 % weight reduction of cars and trucks [1] as well as 5.1 % improvement in fuel economy of hybrid vehicles and 13.7 % increase in maximum range of electric cars [1]. Such limitation of fuel use leads to suppression of the global emission of CO_2 by few tens of million tons per year [2]. The above numbers illustrate the large pressure oriented on design of the new lightweight structural materials, attractive also for other industrial branches.

Among all light metals, titanium is the only one belonging to the group of transition metals which, due to the presence of d-type valence electrons, have metallic, mixed and covalent bonding states [3, 4]. The above electronic configuration causes pure Ti to crystallize in a hexagonal closed-packed lattice (HCP), which can undergo allotropic transformations as a result of the presence of additional alloying elements [5]. The most frequently observed second structural form of Ti is the body space-centered configuration (BCC) occurring in Ti alloys containing the later transition metals (larger number of electrons and higher period). This relationship is used in Ti alloys containing V, Nb or Mo which create the two-phase HCP + BCC Ti alloys [6]. These metals however, are the weak or moderate stabilizers of the BCC phase [7], so their concentration reaches several to tens of percent [8]. Submitted project focuses on the use of the strongest BCC phase stabilizer, i.e. rhenium as a micro-alloying element (concentration up to 1 wt%) to obtain the new and better properties. Preliminary research showed the high effectiveness of the proposed approach, revealing a previously unattainable combination of strength and plasticity of the tested systems.

Accordingly, the overall objective of the project is to determine the efficiency of micro-alloying in the context of improving the mechanical properties of novel Ti-Re alloys. In addition to general objective, three special goal have been set: (i) examination of the influence of Re concentration on the tensile properties of Ti-Re systems, (ii) description of the impact of ternary interstitial and substitutional solutes on Re-doping - *ab initio* calculations, tensile tests, microstructure observation and (iii) determination of the impact of heat treatment on the structure and mechanical properties of investigated systems.

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