

DESCRIPTION FOR THE GENERAL PUBLIC

The research of new materials with attractive combination of mechanical and physicochemical properties is one of the most important tasks for materials science. Numerous studies concerning the effect of alloying elements, carbides and intermetallic compounds on the properties of iron-based alloys allow the design of new materials with unique properties. In this project determination of the possibility to design a material that combines the advantages typical for different groups of iron based alloys, i.e. high wear resistance of hypoeutectic alloys, which are in situ composites (BCC and/or FCC matrix strengthened by eutectic carbides), high physicochemical properties of stainless steels and high strength, and toughness of precipitation hardening (PH) steels. The research plan involves the design, manufacture and characterization of new alloys (in situ composites) from the Fe-Cr-Ni-Mo-C system. The research, which aims to characterize the microstructure, phase transformations, mechanical and physicochemical properties, will allow to understand relationships between: chemical composition – volume fraction, type, and morphology of carbides; chemical composition – crystallographic matrix structure; chemical composition – type and morphology of intermetallic compounds precipitated from the matrix; phase transformations – changes in microstructure and properties. It is assumed, that the new alloys will be characterized by greater wear and high-temperature oxidation resistance in comparison with conventional iron-based alloys. The research results will be used to build a systematic knowledge about the new group of alloys, which in future could be used to design new materials with a high volume fraction of carbides and matrix with high physicochemical properties, strengthened additionally by intermetallic compounds. The reason for undertaking a research subject, as described in the project, is the desire to raise awareness about the possibilities of design the unique combination of mechanical and physicochemical properties in iron-based alloys, despite the fact that it is the best studied group of metallic materials.