Description for the general public

Chromium(VI) compounds, which are highly toxic, are frequently applied as the efficient corrosion inhibitor for aluminium and its alloys, for instance in the orthophosphoric(V) acid aqueous solutions. They are used for the selective dissolution of the anodic coatings, obtained during anodising of the aluminium alloys. During the dissolution of the anodic coatings, chromate ions ensure that the metallic substrate will remain untouched. Such a stripping solution is commonly applied in order to determine the mass of the anodic coating. It is their important feature which has significant influence on the properties of the coating. Preparation of the novel, environmentally-friendly stripping solutions will reduce the risk of the significant diseases of the employees in the aluminium finishing industry. The negative influence of the industry on the environment will also decrease. In addition, the costs concerned with the treatment of the wastewater containing Cr(VI) species will be lowered

Molybdates, tungstates and vanadates are regarded as the promising replacement for the toxic chromium(VI) compounds. Thus, the aim of the proposed project is determination of the mechanism and kinetics of the corrosion of the θ (Al_2Cu) intermetallic phase, from the binary Al-Cu phase diagram, in the aqueous solutions of the orthophosphoric(V) and sulphuric(VI) acids, in the presence of inorganic corrosion inhibitors: molybdate, vanadate and tungstate ions.

The θ phase is the important structural constituent of the Al-Cu-Mg alloys, widely applied in the aircraft industry. It improves the strength of the material after the heat treatment, but at the same time deteriorates its corrosion resistance.

The influence of the chemical composition of the solution (*i.e.* the kind of the acid and corrosion inhibitor, their concentrations, the presence of molecular oxygen dissolved), temperature and stirring on the mechanism and the kinetics of the corrosion of the θ phase will be determined. The corrosion kinetics will be evaluated by using the electrochemical methods such as linear polarization and electrochemical impedance spectroscopy. The non-electrochemical (gravimetric and spectrophotometric analysis of the concentration of the colourful products of the corrosion process in the orthophosphoric(V) acid solution) will also be applied. The susceptibility of the θ phase to the pitting corrosion will be evaluated electrochemically (analysis of the anodic polarization curves). The protective properties of the corrosion products, formed onto the surface of the θ phase will also be investigated.

The inhibition efficiency of the proposed inhibitors, as a function of their concentration at the room and elevated temperature will be calculated for various concentrations of the acids. The activation energy of the corrosion process will also be determined. Finally, on the basis of the obtained results, a kind of a “map” of the corrosion resistance of the θ phase depending on the applied acid, corrosion inhibitor, their concentrations and temperature will be prepared. The detailed knowledge about the mechanism and the kinetics of the corrosion of the θ phase in the acidic solutions, in the presence of proposed inhibitors, will help to develop a new, environmentally friendly solutions for stripping of anodic coatings. It will reduce the utilisation of the toxic chromium(VI) compounds in the industry.