Description for the general public

The goal of the project ***„Microstructure and the properties of selected austenitic steel grades for the USC boilers”*** is the determination of the oxidation resistance of following steels: CR30A, NF709 and SAVE25. The topic address the problem of oxidation wear of above mentioned materials in the atmosphere of water vapor and combustion gases, simulating the operation of boiler, co-combusting the biomass or waste with coal. Combustion gas contains in his composition sulfides, chlorides, fluorides and oxides which are very aggressive to the steels. Hot corrosion wear of materials is the significant problem for the power generation industry, where majority of installation parts (eg superheaters or reheaters) are exposed to water vapor and combustion gas. The main reason of the undertaking the following topic are the huge material losses resulting from corrosion wear in power generation industry.

Therefore in the following project, various grades of the austenitic steels will be subjected to the high temperature oxidation in the combustion gas and water vapor atmospheres. Such approach states the good simulation of conditions not only inside the USC boiler, co-combusting the biomass or waste with coal but also inside the superheater tube, exposed to the water vapor. Chemical composition of both environments were carefully selected to simulate the real conditions inside the boiler co-combusting biomass or waste with coal. Due to such approach, possible is to investigate not only the corrosion resistance of selected materials but also microstructural changes of materials induced by the corrosion. On this basis it’s possible to predict the behavior of investigated materials during operation in real conditions of boiler or steam superheater.

The oxidation resistance of CR30A, NF709 and SAVE25 steels will be evaluated not only by determining the kinetic curve of oxidation, but also by macro- and microscopic investigation of changes of material microstructure and morphology of oxide scale. Moreover, chemical- and phase composition of steel as well as oxide scale induced by certain oxidation medium will be performed. In addition, the impact of alloying additives on the oxidation process of selected steels will be determined. Also very important goal of the project is the determination if the unfavorable phases such as Z, σ or other ones of TCP group are present after long-term exposure to the temperature and corrosion environment. the influence of the elements’ mutual diffusion on the speed and the progress of corrosion process will be also assessed. These investigations will give the answer about the ability of the material to work at supercritical parameters. Performed investigations will provide valuable information concerning the influence of oxidation in atmospheres of water vapor and combustion gas on the selected steels (CR30A, NF709, SAVE25), the use of which could be a break-through in the power industry.