

Abstract of doctoral thesis

This doctoral dissertation raises an important problem from the point of view of the energy industry, concerning the degradation of the microstructure and mechanical properties of austenitic steel. The practical aim of the research carried out in the work was to compare the effect of long-term aging on changes in the microstructure and selected mechanical properties of creep-resistant austenitic steels - Super 304H (X10CrNiCuNb18-9) and HR3C (X6CrNiNbN25-20). Experimental research was preceded by a literature review, in which two main chapters were distinguished. The one contains comparative characteristics of Super 304H and HR3C steels in terms of chemical composition, microstructure and mechanical properties. The second chapter is devoted to the description of the mechanisms of microstructure degradation and its impact on the mechanical properties of creep-resistant austenitic steels used in the power industry. The literature part is closed with the third chapter, which is the justification for taking up the topic of the doctoral dissertation. Based on literature studies and preliminary own research of Super 304H and HR3C steels, the thesis and the objectives of the work were formulated, included in the fourth chapter, opening the experimental part of the dissertation. The following chapters 5 ÷ 8 present the scope of the research carried out and characterize the tested materials. Research results on microstructure analysis and precipitation processes as well as mechanical properties are included in Chapter Nine. In order to determine the influence of long-term aging of the tested steels on changes in their microstructure and mechanical properties of the tested steels, the following tests were carried out using light, scanning and transmission electron microscopy, computer image analysis, Vickers hardness measurement and impact test. It has been shown that long-term aging of the tested steels leads to a gradual degradation of their microstructure, primarily through the preferential separation of secondary phases and changes in their morphology. Changes in the microstructure, in turn, contribute to the progressive reduction of mechanical properties. The analysis of the precipitation processes, taking into account the temperature and aging time, was presented using the author's time-temperature-release charts. The conclusion of the conducted research is an attempt to answer - to what extent these changes will affect the stability of the microstructure and creep-resistant properties of austenitic steels, which was included in the summary and conclusions of the obtained test results.