ABSTRACT of PhD THESIS

**Study on nanomaterials by using method**

**Chemical Potential Programmed Reaction (CPPR)**

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The main objective of the doctoral dissertation was to present a new research method Chemical Reaction Programmed Potential (CPPR) for the study of nanomaterials. In the research work as the nanomaterial was used an iron catalyst for the synthesis of ammonia, whose basic component is iron with a nanocrystalline structure.

In the first part of the dissertation is a literature data review in which the most important models of chemical reactions in the solid-fluid system are discussed. The current state of knowledge regarding the iron catalyst for ammonia synthesis and the iron-nitrogen system is presented. The analytical methods used in the research work were presented, such as: thermogravimetry, X-ray powder diffraction, Mössbauer spectroscopy, scanning electron microscopy, atomic emission spectroscopy with plasma excitation, and low-temperature nitrogen adsorption and desorption.

In the second part of the dissertation the material used in the research is characterized. The assumptions of the CPPR method were discussed and the possibility of its application in two method configurations was presented: CPPR-TG and CPPR-XRD/in situ. In the following chapters presented the methodology of experimental research and the results obtained. The presented studies concerned nanocrystalline iron nitriding processes and reduction of obtained nanocrystalline iron nitrides carried out at steady states and in states close to chemical equilibrium (CPPR method). All processes were carried out at a temperature in the range of 300°C - 400°C. The study of process using the CPPR method was realized out by continuously changing the chemical potential of the gas phase according to a given procedure and analyzing changes in the studied sample by thermogravimetric or x-ray method.

Based on the research, conclusions were made regarding the applicability of the Chemical Potential Programmed Reaction (CPPR) method for the study of nanomaterials. New knowledge on the phenomena observed in the studied nanocrystalline iron-ammonia-hydrogen system in the temperature range of 300°C - 400°C was also presented.

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