# Introduction

The present thesis has the main objective of defining the practical solutions for increasing the durability of the refractory steel casting components in order to work in high temperature conditions, repeated heat shock, specific to the use in the thermal treatment furnaces. Experimental Research is part of UTTIS INDUSTRIES effort, in collaboration with Polytechnic University of Bucharest, to develop technical and technological solutions to improve the quality of castings made from refractory steels. This sustained effort is justified by the high cost of these components (due to Ni and Cr) which increases the durability in service which a supplier can provide either an important factor on which the competitiveness of a supplier on the free market depends. The results will be applied in the productions of UTTIS INDUSTRIES for devices and spare parts made from refractory steels for thermal treatment furnaces.

The research focused on the austenitic refractory steels currently used for specific applications in the manufacture of refractory devices for heat treatment, aiming at deepening some still little studied aspects regarding the structural evolution of these materials during their technological existence, starting with the casting operation and until the conditional exploitation. Therefore, the experimental analysis starts from the premise that the structure of the material has a great influence on its exploitation characteristics, being in turn depending on the presence and the content in alloying elements and the thermal treatment applied to the parts after casting. Also, considering the scope of use, consideration was given to the possibility that the structure of the materials would be affected during exploitation by exposure to repeated thermal treatment.

The paper is structured in 4 chapters. In the first chapter, starting from the specific field of use, we analyze the influence of alloying elements on the structure and the mechanisms by which the structure of the refractory steels can evolve in a negative sense, to the loss of optimal exploitation properties. On the basis of the analysis is established the optimal method of evaluation of the structural mechanisms during the experimental passage of all technological stages through which these components pass, respectively, thermal treatment, use under operation conditions. The element set as the parameter of analysis is the content of carbide in the steel because this content is directly related to possible negative structural changes.

In the second chapter is presented the working plan and the experimental method used for carrying out the research, the results obtained being included in the third chapter.

The third chapter is structured in 3 subchapters, as follows:

- The first subchapter presents the analysis of cast steel components influence on its carbide content.

- The second subchapter presents, analysis the influence of thermal treatment parameters on carbide content of the refractory steels with variable carbon contents.

- The third subchapter is dedicated to the analysis of structural changes during use in operating conditions specific to thermal treatment devices, and the successive thermal treatment in exploitation conditions on the tendency of cracking of the components of refractory steel is analyzed.

The results obtained in first three stages were used to perform statistical processing by which mathematical models of structural evolution were established on the basis of specific analyzes parameters.

The fourth chapter of the paper presents the general conclusions of the experimental research.