



ADVANTAGES OF HIGH STRENGTH STEELS APPLICATIONS IN MECHANICAL CONSTRUCTIONS

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Abstract: *In this paper, the advantages of high strength steels applications in modern mechanical constructions are shown by literature overview. Also, those advantages are put in correlation with particular mechanical design procedures which are required by those applications. The concrete tasks in design procedure which are related to applications of this steels are recognized. Analyses of demands, which are introduced to actual mechanical constructions, showed that those constructions obtained many and very diverse functions. On the other hand, those constructions have to fulfill strict limitations, which are opponent by its nature. Higher demands in energy efficiency and rising prices of materials impose reduction of constructions' weight. The design constraints and presented facts, altogether, implicate that the material selection is one of the most important procedure of design process. Also, only application of high strength steels can fulfill the most of the constructional demands. It is concluded in the paper that application of high strength steels obtain the reduction in emission of pollutants without compromises in safety, reliability and affordability. Furthermore, the major guidelines for improvement of design process of the mechanical constructions made of those steels are highlighted in this paper.*

Key words: *high strength steels, mechanical properties, construction, joint methodologies, design*

1. INTRODUCTION

The characteristic of the high strength steels provide its very wide and different application, from specific zones of vehicles body to highly loaded pillars and offshore platforms. Typical applications are: mobile cranes, utility vehicles, railcars, concrete pumps, containers, agricultural and forestry machinery. The modern demands that are set

on mechanical constructions induce significant decrease of usage of those steel grades. Replacing conventional structural steels by high strength steels results in unchanged load capacities with simultaneous reduction in material thickness of up to 70%. Significant reductions of thickness can be archived even under difficult load conditions. By those facts, the application of high strength steels in mechanical constructions is the key to successful light weight design.

The light weight design solutions are not the same in shape and dimension as the design solutions that they functionally replaced. The stress states in those design solutions are very complex. The analysis of those stress strain states are the basis of the design integrity analysis. The decreases of dimensions at the cross sections of elements, done by applications of high strength steels conditioned the decreases of dimensions at zones of joints of elements. Due to those facts, the time for mechanical construction forming is reduced. Applications of high strength steels give the higher levels of flexibility in design of mechanical constructions. The mechanical properties and higher resistance to atmospheric corrosion of high strength steels improve the safety and reliability, so it reduced maintains costs of constructions made of those steel grades. The recycle ability of those steel grades at the end of exploitation period of the constructions provides reductions of ecological impacts. But, the applications of those steel grades conditioned significant and specific problems. The adequate solutions of those problems are conditions of applications validities [1, 2 and 3].

In this paper, some specific problems related to applications of high strength steels in mechanical constructions are presented. Specific problems of applications are put in correlations to characteristics and properties of high strength steels. The meta analysis of typical applications of high strength steels, found in present literature survey, are given in this paper to highlight the specific problems that must be solved in design procedures. The nature, characteristics and properties of high strength steels are briefly discussed in the paper to establish the set of influential factors of high strength steels applications in mechanical constructions.

2. HIGH STRENGTH STEELS

The high strength steels are developed in order to provide the favorable mechanical properties and higher corrosion resistance in relation to conventional carbon steel grades. Those steel grades are not classified as alloyed steel grades in common manner because its main requirements are defined mechanical properties. The chemical compositions of those steel grades are of less importance. The chemical compositions of those steel grades can even vary in order to ensure the homogeneity of mechanical characteristics by those variations. The high strength steels are usually produced as sheets and plates with low carbon content (0.05% to 2%), while manganese content is not higher than 2.0%. The sheets and plates are characterized by an extremely uniform surface and homogeneous microstructure across the entire cross-section. Those steels also contain small amounts of nickel, molybdenum, copper, nitrogen, vanadium, niobium, titan,

