World Journal of
Engineering

Wold Journal of Engineering 5(2) (2008) 34-40

Influence of heat ttreatment on brittle fracture welding cords of constructional steels

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(Received 15 July 2007; accepted 1 June 2008)

Abstract

The welded joints are the seat of high residual stresses, localized in the vicinity of the cracks of the weld cord. Their presence plays a major part with respect to certain damaging modes such as stress corrosion, tiredness, the brutal rupture and the increase in the temperature of ductile-brittle transition.

The operation of welding can be comparable, from the point of view of the heating effect, with a process of non-uniform heating. With cooling, at room temperature, the welding cord and the close zones towards the base metal are partially obstructed by the little zone overheated during welding. Tensile residual stresses will then occur in the cord and in adjacent zones. These stresses which are balanced by residual stresses of compression will be developed in the zones further away from the cord. A heat treatment after welding is generally carried out with the aim to: firstly, to reduce the residual stresses and secondly to obtain the desired nuance of the molten zone and the thermically affected zone (Lamberd, 2001). The results discussion is based on observations and analyzes of the phenomenon resulting from the various tests carried out under various conditions by using recent techniques.

Key words: *Welding, Heat treatments, Residual stresses, Brittle fracture, Impact strength, Micro-hardness, Microstructure*

1. Introduction

The welding operation results in local metallurgical modifications of the base metal according to the testing methods used. Thus, the experimental tests can lead to the creation of a molten zone from which the structure and the properties are more or less different from those of the base metal. In addition, the welding operation also establishes a state of residual stresses whose distribution and amplitude are also function of the experimental methods.

Whatever the characteristics, metallurgical or thermo-mechanical, the modifications are often tolerable with respect to the conditions of service and thus the welded parts are used as they have been received. In certain cases, however, it is considered to be preferable or necessary, or even in some cases it is obligatory to undergo a heat treatment after welding, whose principal object is to improve or obtain better properties with respect to the operating conditions, and to eliminate or simply reduce the

ISSN:1708-5284