

Cracking of the mixing chamber caused by sigma phase precipitation in austenitic steel welded joints

J. Brózda ^{a,*}, J. Madej ^b

^a *Instytut Spawalnictwa (Institute of Welding), ul. Bł. Czesława 16/18, 44-100 Gliwice, Poland*

^b *Polimex Mostostal Siedlce, ul. Przemysłowa 11, 37-450 Stalowa Wola, Poland*

Received 16 January 2007; accepted 17 January 2007

Available online 2 February 2007

Abstract

In the air mixing chamber of the chipboard production line, made of austenitic X15CrNiSi20-12 steel, cracks have been found, which were located in the fillet welds connecting the suspension ring with the chamber shell and also in the butt welds of the suspension ring. The failure investigation covered temperature measurement of the suspension ring, chemical analysis of welds and parent material, metallographic examination and Vickers hardness measurements of welded joints as well as Charpy V impact testing of the as received samples and after solution heat treatment. The examination results revealed a low impact strength (28–32 J) of the butt weld and parent material, caused by precipitation of sigma phase during prolonged heating at temperatures exceeding 650 °C. After solution heat treatment of the parent material the impact strength was restored to values over 300 J. It was found that the main reason of cracking is the sigma phase formation in welded joints, with its effect of embrittlement, with the crack initiation on stress concentrating welding defects.

© 2007 Elsevier Ltd. All rights reserved.

Keywords: Austenitic steel; Welded joints; Cracks; Sigma phase; Solution heat treatment

1. Case presentation and introduction

In the air mixing chamber of the chipboard production line numerous cracks have been found, which were located in the fillet welds connecting the suspension ring with the mixing chamber shell and also in the butt welds of the suspension ring (Fig. 1).

Examples of crack appearance are shown in Fig. 2.

According to the information from the designer, the temperature on the chamber inlet is 1000 °C and at its outlet (lower part) ca. 600 °C. The mixing chamber and its suspension ring were made of austenitic steel X15CrNiSi20-12 (Material No. 1.4828). Covered electrodes ES 24-18B (EN 1600: E 25 20 B 22, AWS A5,4: ~E310-15) were used for welding.

* Corresponding author.

E-mail address: Jerzy.Brozda@is.gliwice.pl (J. Brózda).

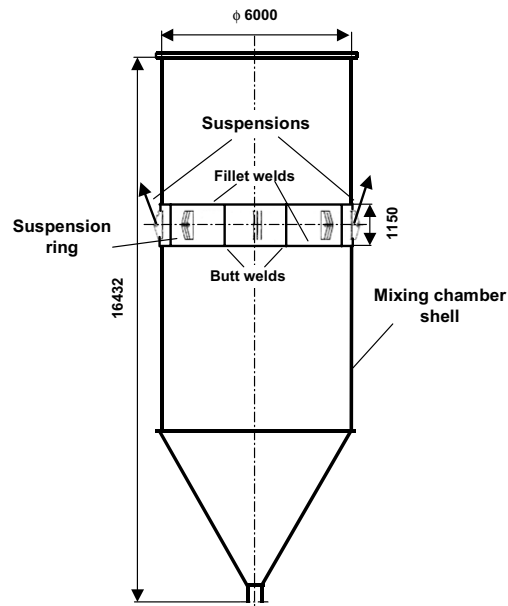


Fig. 1. Sketch of the mixing chamber.

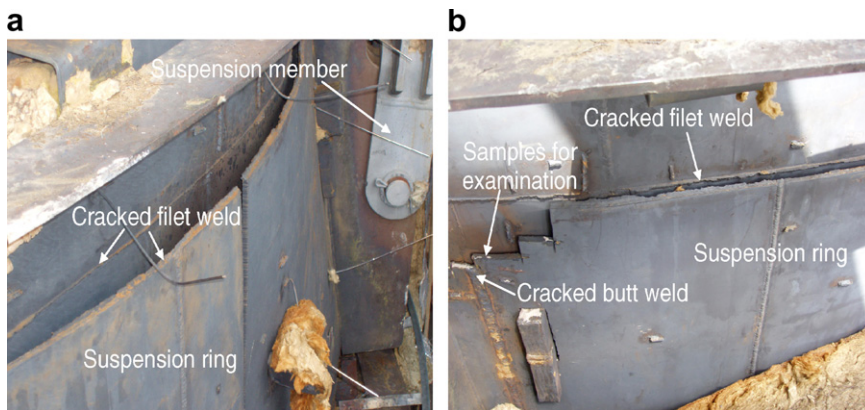


Fig. 2. View of the cracked welded joints connecting the suspension ring with the mixing chamber shell.

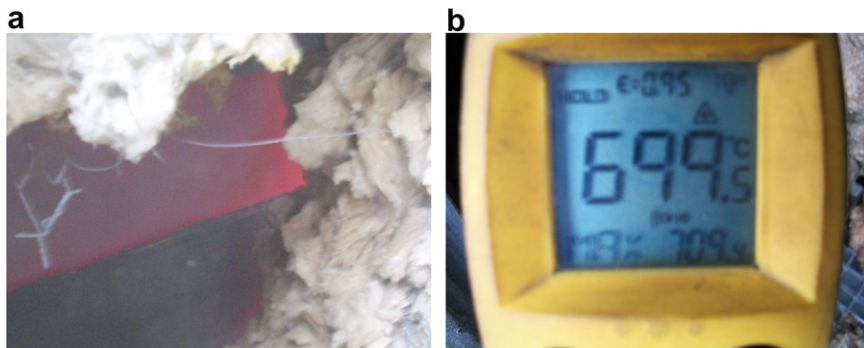


Fig. 3. Temperature measured on the surface of the mixing chamber.

Download English Version:

<https://daneshyari.com/en/article/770110>

Download Persian Version:

<https://daneshyari.com/article/770110>

[Daneshyari.com](https://daneshyari.com)