Reducing fatigue and corrosion in welded structures

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COMPANY PROFILE

Curtiss-Wright Surface Technologies (CWST) offers a single source solution and point of contact for all your surface treatments. We can reduce your turnaround times and costs through our network of over 75 worldwide facilities.

Our proven surface treatments meet industry demands for lighter materials, improved performance and life extension in key markets such as Aerospace, Automotive, Energy and Medical. We can prevent premature failures due to fatigue, corrosion, wear, galling and fretting.

Surface Technologies is a Division of Curtiss-Wright (NYSE:CW) a global innovative company that delivers highly engineered, critical function products and services to the commercial, industrial, defense and energy markets. Building on the heritage of Glenn Curtiss and the Wright brothers, Curtiss-Wright has a long tradition of providing reliable solutions through trusted customer relationships.

Controlled Shot Peening is a technique applied to many machined or fabricated structures to reduce the incidence of fatigue, corrosion fatigue, stress corrosion cracking, fretting or fretting fatigue.

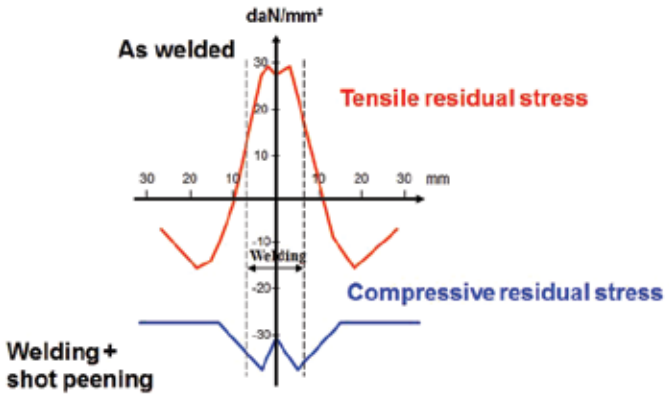
The shot peening process removes any surface residual tensile stresses and substitutes residual compressive stresses whose magnitude can reach 80% of the materials yield strength and up to 2mm in depth, depending on the shot peening parameters selected.

The induced residual compressive stresses are beneficial in reducing the mean stress at the structures surface. Welded structures have gained significantly by the application of this technique and typical applications include wood pulp digesters, deaerators, liquid petroleum gas vessels, MEA tanks, ammonia spheres, steam generator tubes in nuclear power plant, bridges and offshore structures.

PROCESS CONTROL MECHANISMS

The success of shot peening and repeatability as a production technique is achieved by controlling the application mechanisms and correct selection of shot peening parameters. These include choosing the correct material and size of media, predetermining the shot intensity using Almen test strips and confirming the amount of coverage needed to achieve the required result, 100% being the minimum.

Visual inspection is normally undertaken after processing to ensure complete coverage of the surface, but on a large structure this is extremely difficult to carry out, hence the development of fluorescent traces or dyes. These dyes are specifically formulated for this task and are sprayed or brushed onto the surface prior to treatment and allowed to dry. When examined under ultraviolet light the surface appears light green. Any areas of light green that remain after processing will indicate where additional coverage is needed. It is essential that this technique is also applied on welded areas to ensure complete penetration into the weld toe, weld laps or porosity.



Construction steel E460; TIG welded

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WELDING STRESSES

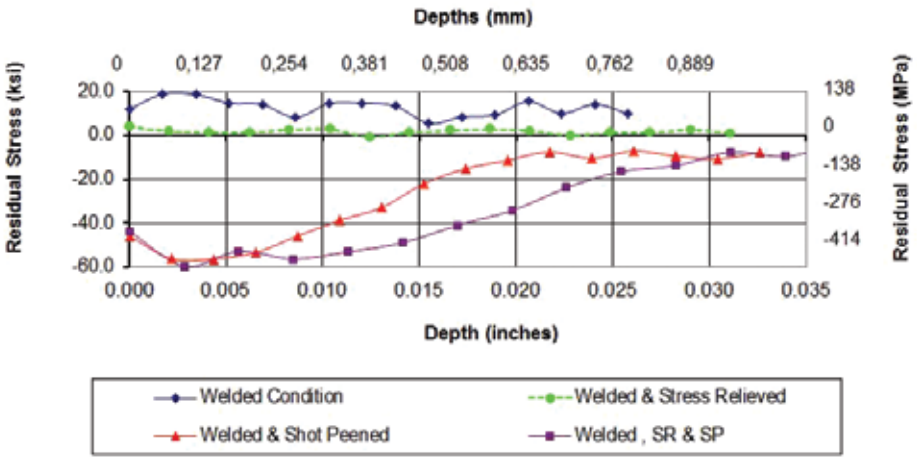
The problem of welding stresses at the heat affected zone has been tackled by a variety of means and their success varies. Thermal or mechanical stress relieving reduces residual tensile stresses, but has less effect on applied stresses.

Hammer or needle peening are techniques adopting the same principles of shot peening but the significant difference between them are the process controls so consistency and coverage are a problem. Shot peening has been developed to become a reliable production method.

A welded area will benefit from controlled shot peening, however a greater benefit can be achieved by peening a dressed weld. This is because the areas of stress concentration have been reduced and impurities close to the weld surface have been removed.

CORROSION FATIGUE / STRESS CORROSION CRACKING

Stress corrosion cracking is a progressive fracture mechanism in metals caused by the simultaneous interaction of a corrosive environment and a sustained tensile stress. Failures are often sudden and unpredictable and may occur after a few hours, months or years. Stress corrosion cracking generates from static tensile stresses which may be residual or applied, whereas corrosion fatigue comes from cyclic tensile stresses.



1020 (C22E) Material: BRN 150–180; Rb 80-90
Welded Filler Rod: 7018 – 3/32"
Shot Peening: MI-460H @ 16-20A

Compressive residual stresses can be used to prevent or delay both stress corrosion cracking and corrosion fatigue. The application of controlled shot peening will induce a deep layer of residual compressive stress to establish defect or damage tolerance necessary to resist in service problems.

SITE WORK

Controlled Shot Peening is applied to many structures on site for the chemical, oil and gas, highway and construction, power generation, aerospace and other large transport industries.

The controls mentioned earlier are applied in all of these situations. Media is taken to site and examined initially and continuously to ensure the desired profile of residual compressive stress is maintained. We have portable machines to impart the necessary level of intensity required for site work on welded structures. For coverage inspection, fluorescent dyes can be effectively applied on-site using low voltage equipment and suitable localised enclosures.

We are completely self-sufficient in manufacturing our own tools and are able to adapt or build equipment to suit.

We ensure our onsite teams are experienced in health and safety regulations for field work for all key industries.

Please view our website www.cwst.co.uk for all facility contact details worldwide.

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