

ULTRASONIC IMPACT TREATMENT - HFMI

Conventional Hammer Peening is a well-known post-weld treatment for fatigue life improvement. This method is applied to the weld toe only.

Ultrasonic Impact Treatment (UIT) or High Frequency Mechanical Impact (HFMI)) is a process achieving the same effect, but with more process control compared to conventional hammer peening. UIT is also faster and far less harmful for the operator.

## **STRESSONIC® TECHNOLOGY PRINCIPLE**

On an Ultrasonic Peening system, an electrical signal is created by an Ultrasonic Generator and then converted to a mechanical vibration by a piezo-electrical converter. This mechanical vibration is amplified by a sonotrode and used to drive the needle to achieve the high frequency peening.

- 1. Piezo-electrical converter
- 2. Sonotrode
- 3. Specific Impactor (Or Needle)
- 4. End piece (to guide the Impactor)

5. This scheme illustrates the movement cycle of the impactor inside the end piece



Acoustic element inside the UNP peening head

## **TWO MAIN EFFECTS OF HFMI PROCESS**

- 1. Modification of weld toe geometry
- 2. Compressive residual stresses/stressrelief

Post-weld treatments, such as HFMI, consist of increasing the radius and introducing high level of compressive residual stresses at the weld toe.

This impact treatment leads to a high level of fatigue life improvement.



Ultrasonic Impact Treatment principle



After UIT, we observe high compressive residual stresses down to more than 1.4 mm for all conditions. As for shot peening (or Ultrasonic Shot Peening), compression is beneficial for the fatigue life improvement, acting against the service loads and improving the Stress Corrosion Cracking (SCC) resistance.

Residual stress profil (transversal direction) - Multi pass angle welding on weld toe (Steel S355)



## **RESULTS WITH SONATS EQUIPMENT**

SONATS has more than 30 years of experience in research for impact surface treatment activated by an ultrasonic vibration: the STRESSONIC<sup>®</sup> process. Most of these research programs have been conducted under confidential agreements with end-customers.

Following table sums up the FAT obtained on S355 specimens according to the post weld treatment.

S355J3+M	FAT (+2.3%)	% of FAT Improvement (to AW)
IIW Recommandation	90 Mpa	VC-
As welded	118 Mpa	-
With UIT (Standard parameters)	176 Mpa	49%
With UIT (Double radius peen)	216 Mpa	83%









Fatigue Curve on S355, UIT with standard parameters



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