THE ROLE OF SAMPLE GEOMETRY IN LASER PEENING-INDUCED COMPRESSIVE RESIDUAL STRESS FORMATION

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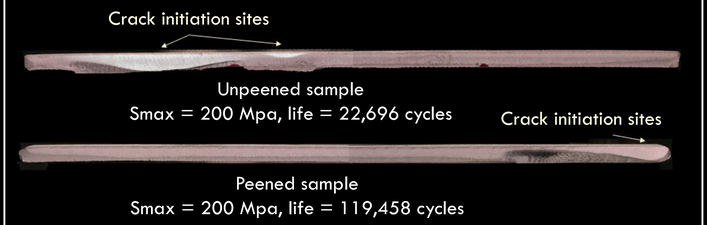
Introduction

Previous research revealed that laser peening can increase the life of as-welded FSW joints by up to a factor of 2.

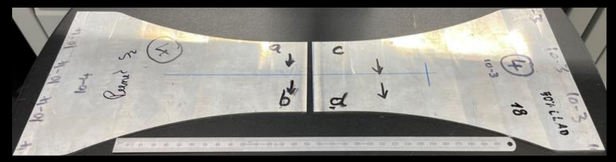
However, cracks consistently initiate near the free edge of the laser peened fatigue samples.



Materials and methods

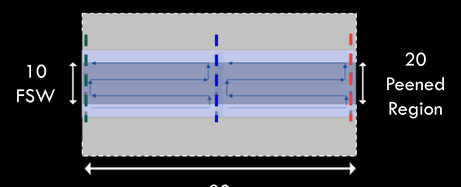
The **contour method** is a destructive residual stress measurement method that obtains a 2D residual stress map with a single measurement process in one principal strain direction.

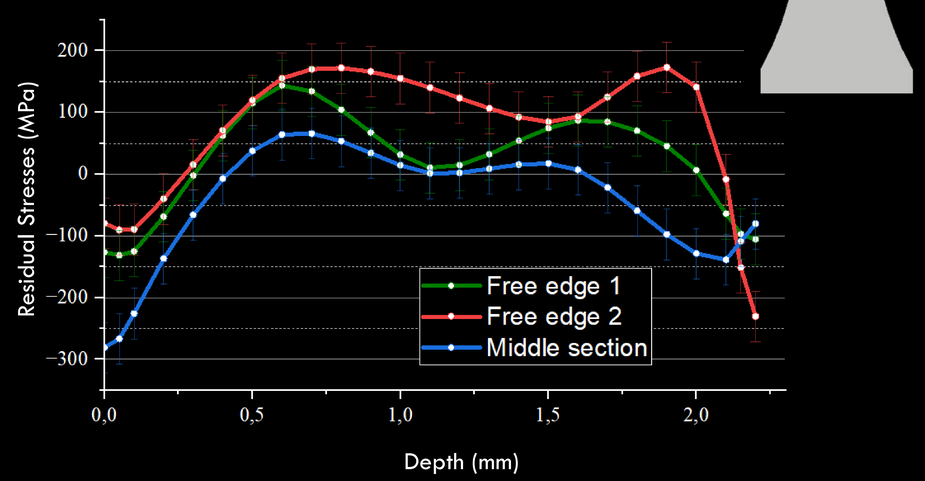
This method was used to measure the residual stress state along the longitudinal axis of the sample.



Results and discussion

The compressive stresses near the free edges were significantly lower when compared to those in the middle section of the weld.





When peening next to a free edge, there is less material available for constraining the deformation.

Ineffective peening causes a lower magnitude of compressive residual stresses, limiting the potential improvement in fatigue life

Conclusions

The laser peening treatment is **less effective** in generating compressive residual stresses near the free edges of the samples.

The local regions of reduced compressive residual stress near the free edges of the sample are **limiting the benefits of peening.**

The **identification of a solution** to the reduction in compressive residual stress near the free edges is crucial for achieving **optimal improvements** in the fatigue life.

Further information

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