# Multi-mechanism Modeling of Strain Memory Effect on Cyclic Stress-Strain Curves of Stainless Steel 304L

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## ABSTRACT

To determine the required parameters for reliable and accurate prediction of fatigue life, the stabilized stress-strain cyclic curves are generally necessary. The cyclic behavior and the effects of loading history on the cyclic stress-strain curve of 304L stainless steel at room temperature were investigated here. Cyclic tension-compression strain control experiments were carried out in four loading sequences with increasing/decreasing strain amplitude on the same specimen. The first sequence is composed of (applied cycles/strain amplitude): (50/0.2%), (40/0.3%), (30/0.4%), (20/0.5%), (20/1%) and (10/1.5%). The second sequence is a progressive come back to the origin.

Results show that the cyclic curve is not unique, as it depends on the maximum strain range reached earlier. By increasing the number of sequences, 304L has a tendency to get an asymptotic cyclic curve. Strain hardening seems to be stabilized and the cyclic curves are almost superimposed on the second one. Cyclic strain hardening obtained during sequential cycles was analyzed in terms of kinematic and isotropic hardenings. This strain memory effect is visible on the evolution of internal and effective stresses [1,2].

The multi-mechanism model (MM) [3,4] is evaluated in terms of its predictive capabilities about the 304L SS strain memory effect on cyclic stress-strain curves. A comparison between experimental cyclic curves and those obtained by simulation was performed. The MM model simulation has a good agreement with the experimental results in the description of the strain memory effect observed after the second sequence in particular for high levels of strain amplitude. However, the MM fails in describing the stabilized cyclic behavior in the third and the fourth sequences.

## REFERENCES

[1] A. Belattar, C. Keller, L. Taleb, Materials Science and Engineering: A, 662 (2016) 468-480.
[2] A. Belattar, L. Taleb, A. Hauet, S. Taheri, Materials Science and Engineering: A, 536 (2012) 170-180.
[3] L. Taleb, G. Cailletaud, International Journal of Plasticity, 26 (2010) 859-874.
[4] K. Saï, L. Taleb, F. Guesmi, G. Cailletaud, Acta Mechanica, 225 (2014) 3265-3283.