

Mechanical Properties of SLM Printed AlSi10Mg Alloy

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*Norm Additive, 10002. Sok. No:6A İzmir/TÜRKİYE.

In this paper, the effect of stitch line and specimen placement on the build plate on the mechanical properties of SLM printed AlSi10Mg alloy is presented. In addition, the results were compared to GE Additive's material test results. All tensile tests were performed according to ASTM E08-E8M standard. All specimens were as-build condition and machined to test dimensions using CNC turning. All tests and analysis were conducted in Norm Additive using GE Additive M2 Series 5 DMLM system.

Specimen Orientations

Figure 1 shows the placement and orientation of each specimen on the build plate. Here, *SL* defines presence of stitch line, *V*- vertical direction, *H*-horizontal direction and 45-inclined direction in angle of 45° with reference to build plate.

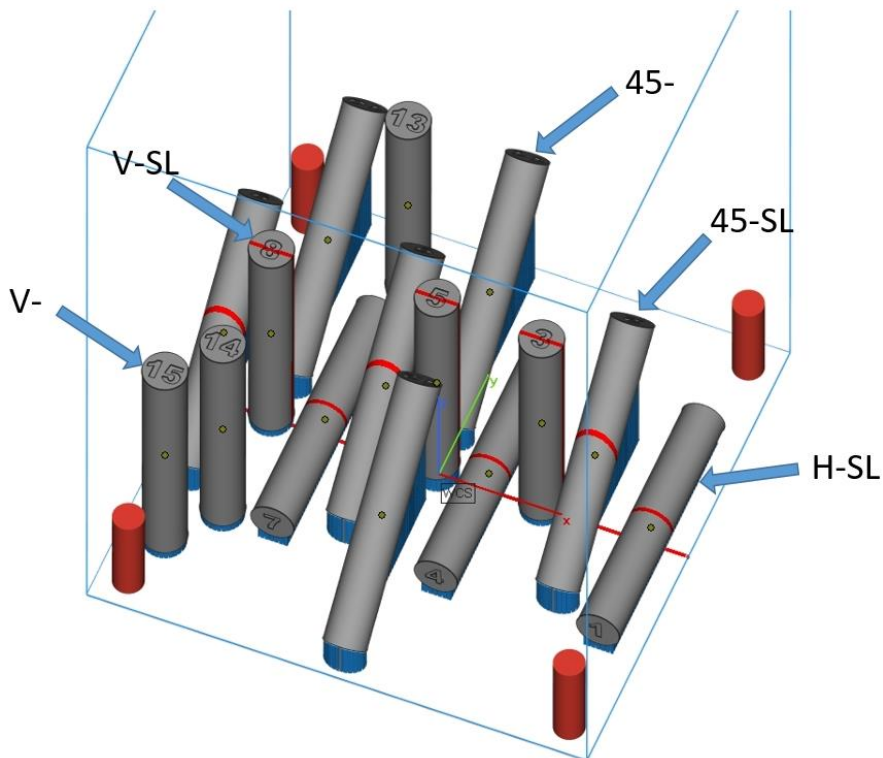
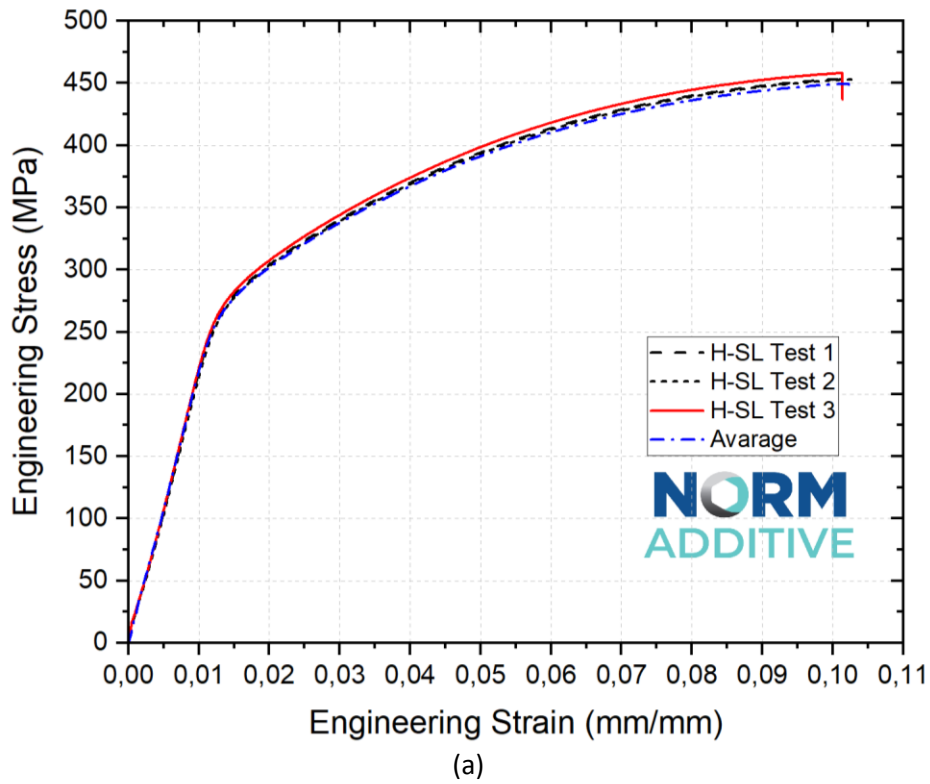
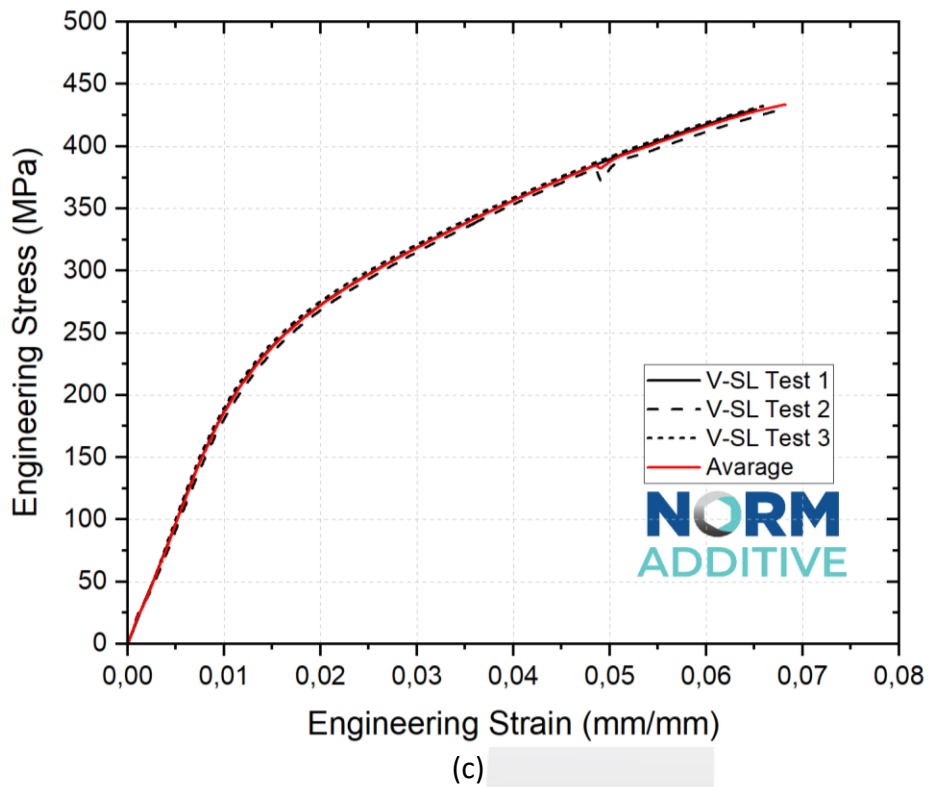
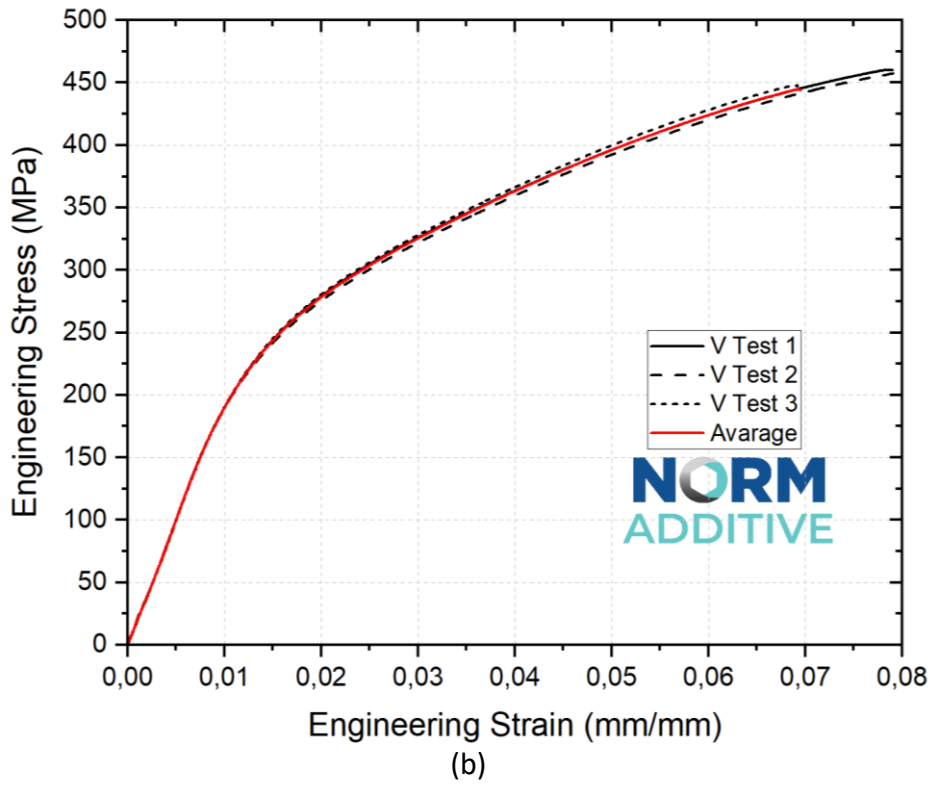


Figure 1. Placement and orientation of each specimen on the build plate

Test Results

Figure 2 shows engineering stress-strain curves of the specimens that are distributed different places of build plate. As seen in the figure, there is no significant difference between the tests for each type of specimen.





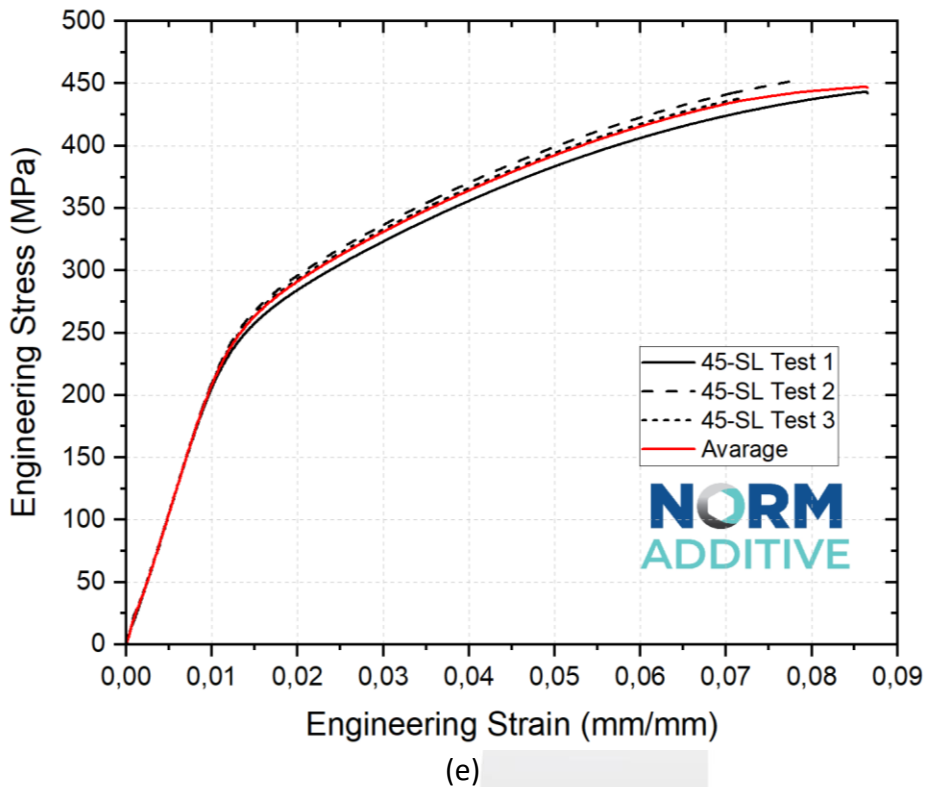
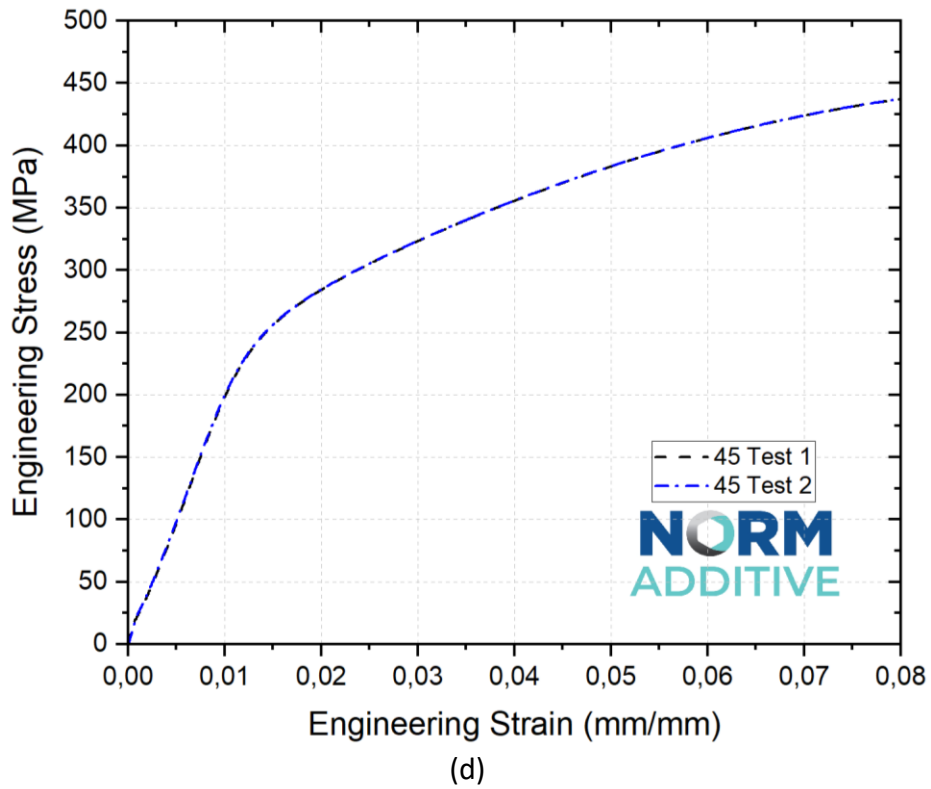


Figure 2. Placement effects on engineering stress-strain curves: (a) H-SL, (b) V-, (c) V-SL, (d) 45-, (e) 45-SL.

Figure 3 shows comparison of elongations of each specimen with GE Additive M2 Series 5 AlSi10Mg standard. Results are in good agreement with the standard.

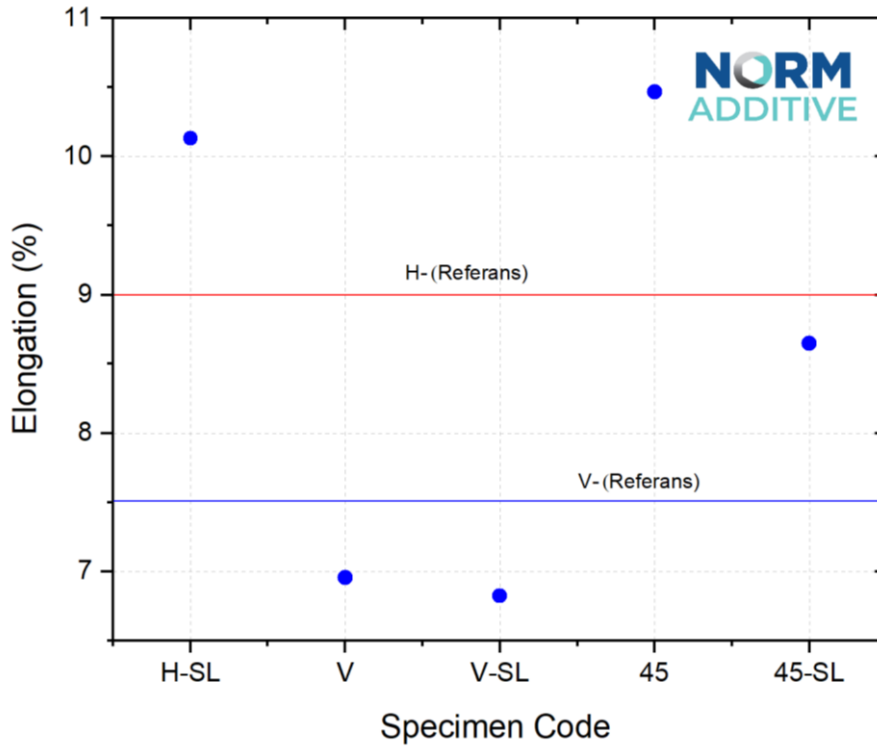


Figure 3. Comparison of elongations according to reference*

* M2 Series 5 Aluminum Al-Si10-Mg - ge.com/additive

Yield stress of AlSi10Mg for each test was determined with proportional and off-set methods as depicted in Figure 4. Although both methods are valid for the analysis, off-set method was used for better comparison with standard. In addition, engineering stress-strain curves were also converted into true stress-strain curves.

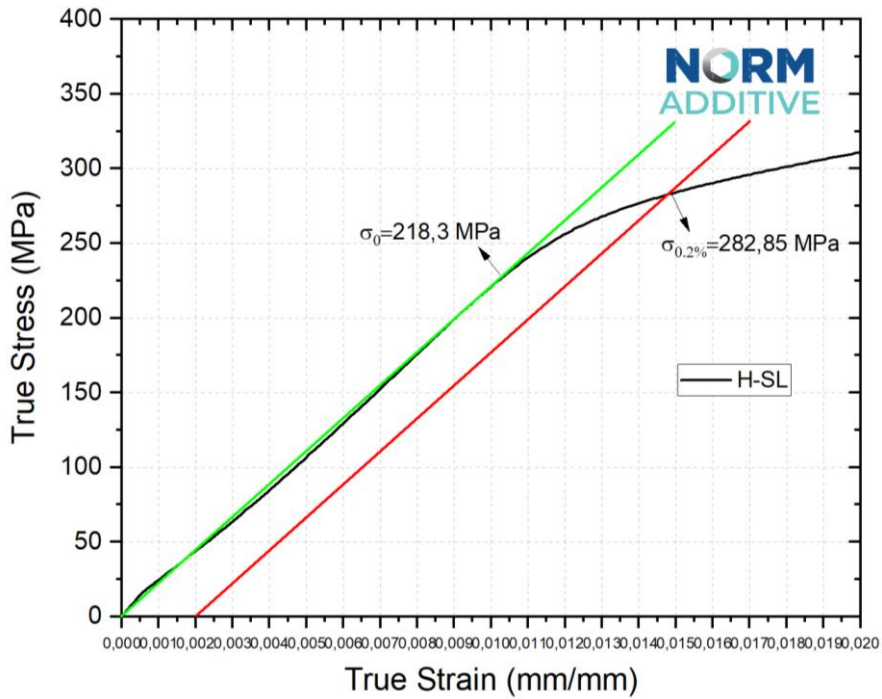
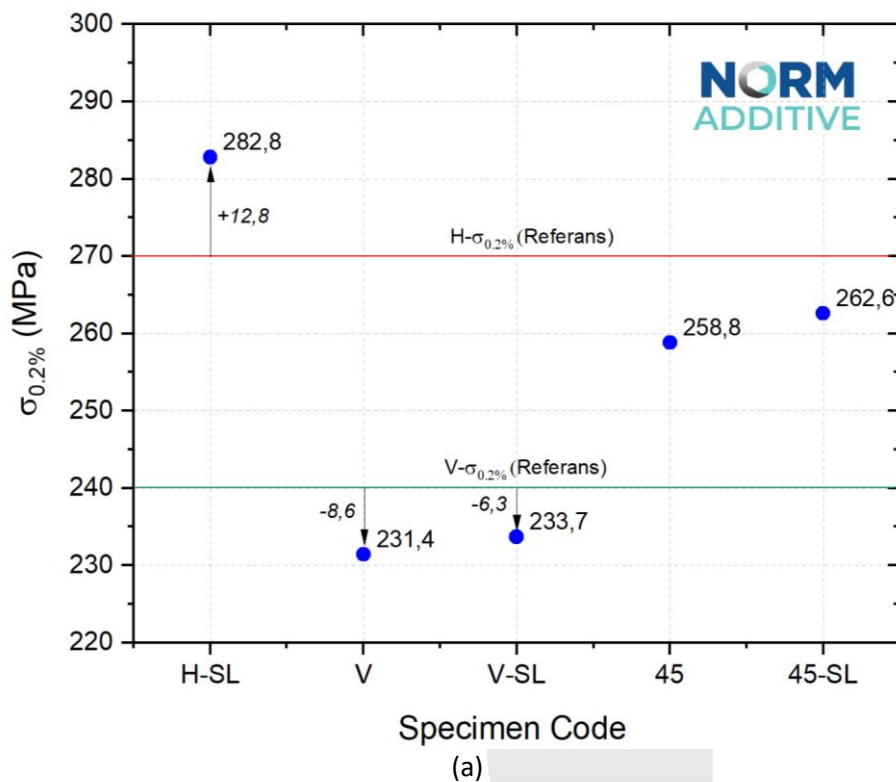
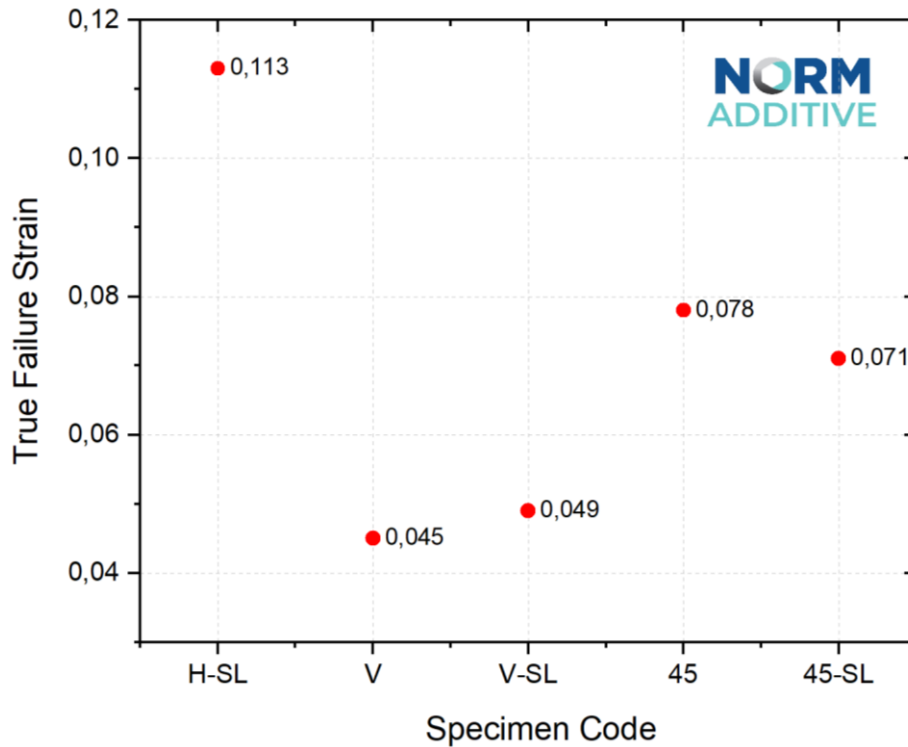


Figure 4. Proportional and off-set methods for yield stress.

Yield stress and true failure stress of AlSi10Mg were given in Figure 5.





(b)

Figure 5. Yield stress and true failure strains of AISi10Mg.

CONCLUSIONS

- Stitch-line presence was shown to be negligible in terms of mechanical response.
- Catalog values of AISi10Mg alloy are in good agreement with real-time production.
- Positioning of the parts on different areas of the build plate has no effect on mechanical response.



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