



L-40: Superior Fatigue Behavior

FATIGUE is the weakening of a material caused by cyclic loading. The FATIGUE PROPERTIES of metal alloys used for components or tools are often key to their performance. This is true for Additive Manufacturing (AM) materials as well as their wrought counterparts.

FORMETRIX L-40, a tool steel specifically designed for AM, has shown outstanding results in fatigue testing - in general and against other leading AM tool steels.

In the graph below, the fatigue performance of Formetrix L-40 is shown to be superior to M300 Maraging Steel in a condition of similar hardness (HRC 46-48). It should be noted that L-40 achieves this hardness with only a stress-relief step (not a heat treatment), while M300 requires additional heat treatment to reach this hardness.

S-N CURVE OF L-40 VS. M300 AT HR 46-48 CONDITIONS

- Data is from testing conducted at Formetrix and external testing labs
- Tested for axial fatigue with -1 loading ratio and 30 hz frequency
- Dashed lines are for visual aid only, not a calculated curve fit
- Open data points to right indicate test was discontinued before failure

Using an alternative approach to measuring fatigue limits, C. Douellou et al. (Procedia Structural Integrity 19, 90-100, 2019) show that L-40 “as-built” maintains a significant relative advantage over M300 Maraging Steel as-built.

SUMMARY

- Fatigue performance can be critical for certain Metal AM applications
- The majority of tool and die applications require strong fatigue performance from wrought and AM materials
- **Formetrix L-40 delivers excellent fatigue performance and exceeds M300 Maraging Steel, which is a frequently used AM tool steel**
- Its strong fatigue performance is another reason L-40 can be used without heat treatment for certain applications, providing important cost advantages for users

