Alternating fatigue characterization of a SAE 5160H steel subjected to shot peening under tension

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Introduction

This job shows four-point alternative fatigue tests for SAE 5160H steel quenched and tempered in oil samples subjected to plastic bending deformation and shot peening (SP) afterwards. The fatigue results were adjusted using the Basquin model. Rockwell C hardness tests and optical microscopy were also performed.

Methodology

Specimens were prepared under ISO 22407 with dimensions of 160 x 15 [mm] x ¼" thickness. Rockwell C hardness tests were conducted on shot-peened and non-shot-peened sides of specimens according to ASTM E18 (see Chart.2). Alternating fatigue tests were conducted using a four-point bending method. Twelve test specimens were subjected to this process distributed in four levels of stress to ultimate strength. Optical microscopy on stereoscope was performed on the test specimens to identify nucleation points.

Figure.1 "Sample specimens."

Results

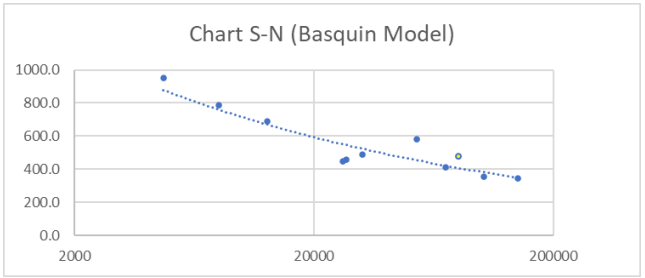
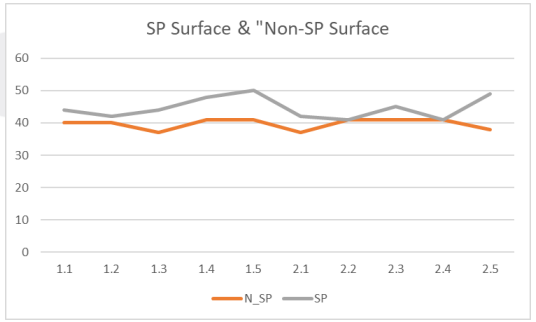


Chart.1 "Basquin model applied to fatigue-tested specimens."

Optical microscopy revealed that the nucleation begins later in the pieces treated with shot peening than in the control pieces, plus, the crack began superficially in multiple regions on the shot peening treated material (see Figure.2), extending the useful life of the material

Chart.2 "Hardness taken on a specimen previously treated with SSP."



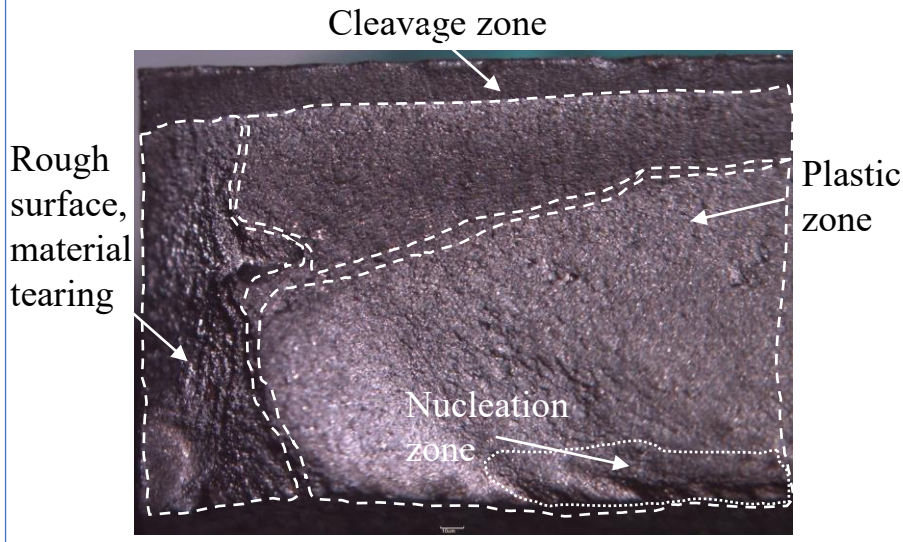


Figure.2 "Front view of the fracture and crack growth in the specimen of interest at 670x."

Conclusions

Shot peening induces compressive stresses on the surface, which provide an advantage over tensile stresses. This helps to extend the life of a spring if the ultimate strength of the material can be increased. Likewise, a less robust spring could be specified to fulfill the same function.

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Conflict of interest: None.