

# **LPB as a Crack Initiation Resistant Process for Case Hardened Steels**

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## **Abstract**

The high cycle fatigue performance of case carburized 9310 rotorcraft gear steel was investigated with shot peening (SP), low plasticity burnishing (LPB), and as-ground surface conditions to compare the relative resistance to crack initiation. A 0.010 in. (0.25 mm) EDM notch was used to simulate damage frequently encountered in rotorcraft gears such as contact fretting induced pitting. In the smooth (undamaged) condition LPB leads to a 10% improvement in fatigue strength over SP and a 20% improvement over the as-ground condition, and in the presence of simulated damage, to a 100% improvement over SP. Residual stress relaxation due to both mechanical and thermal exposure was also investigated. Both LPB and SP lead to similar residual stress relaxation on the surface after a single cycle of mechanical overload. Below the surface, SP leads to either a complete relaxation of the residual compression or a transition into residual tension after the overload cycle, while LPB leads to stable compressive residual stresses. This study paves the way for developing applications of LPB technology for rotorcraft gear components by appropriate design of LPB tools and implementation of the designed residual stresses to improve the fatigue performance and damage tolerance.