CASE STUDIES OF MITIGATION OF FOD, FRETTING FATIGUE, CORROSION FATIGUE AND SCC DAMAGE BY LOW PLASTICITY BURNISHING IN AIRCRAFT STRUCTURAL ALLOYS

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ABSTRACT

Surface enhancement technologies such as shot peening (SP), laser shock peening (LSP) and low plasticity burnishing (LPB) can provide mitigation of foreign object damage (FOD), fretting fatigue, corrosion fatigue, and stress corrosion cracking (SCC) damage. However, to be effective, the compressive residual stresses must be retained in service for successful integration into aircraft structural design, and the process must be affordable and compatible with the manufacturing environment. LPB provides high magnitude deep thermally and mechanically stable compression, and is performed on CNC machine tools. LPB provides a means to extend the lives of both new and legacy aircraft structural components. Improving fatigue performance by introducing deep stable layers of compressive residual stress avoids the generally prohibitive cost of modifying either material or design.

The LPB process combined with an overview of current research programs is presented. Fatigue performance and residual stress data developed to date for several case studies conducted to apply LPB to a variety of aircraft components include:

- Improved fretting fatigue and corrosion fatigue performance with LPB in 4340 high strength steel
- LPB treatment to mitigate FOD, corrosion fatigue and SCC in 300M HSLA landing gear steel
- Corrosion pitting and corrosion fatigue mitigation with LPB in AA7075-T6
- Improved fatigue and corrosion fatigue performance of friction stir welded joints of AA2219-T8751

Where appropriate, the performance of LPB is compared to conventional shot peening.