

**A MEANS FOR ASSESSING THE EFFECTIVENESS OF THE SHOT PEENING PROCESS AS IT  
RELATES TO FATIGUE PERFORMANCE**

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Compressive residual stresses in aerospace materials can contribute significantly to the enhancement of fatigue performance. Conventional shot peening is a technique for imparting beneficial compressive stresses at the surface and the near surface region of a component. The magnitude of the induced compressive stresses is primarily a function of the ultimate tensile strength of material being peened, while the depth of the work-hardened layer is related to peening parameters such as shot size, intensity, and coverage.

X-ray diffraction (XRD) provides a nondestructive method for quantifying residual stress in a material by the direct measurement of strain in the crystal lattice. Elastic strain is characterized by a shift in the diffracted peak position, and plastic strain can be qualified by the width of the peak. This paper presents the results of surface and subsurface residual stress measurements along with axial fatigue data from four aerospace materials shot peened over a range of common peening intensities. With few exceptions, the data correlated well in that higher peening intensities provided greater magnitude compressive residual stresses and strains. However, the best fatigue performance was observed on the lower end of the peening intensity range. Combining XRD residual stress and plastic strain data provides a means to better assess the effectiveness of the shot peening process as it relates to fatigue performance in aerospace materials.