Laser peening
Component protection

Enhancing the performance of metals and materials

www.metalimprovement.co.uk
Laser peening is a globally recognised technology that enhances the fatigue strength of critical metallic components. This process involves the use of high-powered lasers to induce residual compressive stresses into a workpiece, which can significantly increase its resistance to failure caused by cyclic loading.

**Laser peening induces exceptionally deep residual compressive stresses to enhance the fatigue strength of critical metallic components.**

Laser peening is making an important impact on industry following the major transition from a laboratory research and development activity to a reliable and production qualified technology. Laser peening offers designers the ability to surgically place residual compressive stress into key areas of components to retard crack initiation and growth enabling increased fatigue strength ratings.

**The Process**

An output beam, roughly 25 Joules at 18 nanoseconds from a Nl:glass laser is projected onto a work piece to induce a residual compressive stress. The area to be peened can be covered with material to act as an ablative layer and simultaneously as a thermal insulating layer, or peened directly onto the base metal which subsequently may require some form of surface removal of a few microns.

A thin stream of water is made to flow over the surface and the laser light transparently passes through the water, the leading temporal edge of the laser pulse is absorbed on the metal surface or ablative layer. This absorption rapidly ionizes and vaporizes more of the surface material to create a plasma that is highly absorbing for the rest of the laser pulse. A high plasma builds to approximately 100kBar (1 million pounds per square inch) with the water serving to inertially confine the pressure. This rapid rise in pressure effectively creates a shock wave that penetrates into the metal, plastically straining the near surface layer.

This deep level of compressive stress creates a damage tolerant layer and a barrier to crack initiation and growth, which consequently enhances the fatigue lifetime and provides resistance to stress corrosion cracking and fretting fatigue.

**Applications**

Laser Peening has been used for several years to prolong the fatigue life of critical aerospace components such as turbine engines and aircraft structures but is now being used to peen form wing skins to achieve the requirements of the new generation of intercontinental aircraft. Laser peen forming essentially performs the same role as shot peen forming, but because of the greater depth of plastic work, extends the degree of curvatures possible enabling more fuel efficient profiles to be achieved.

Potential applications have also emerged for automotive, power generation, nuclear waste disposal, petroleum drilling, medical implants and recreational sports.

With facilities in the United States and UK, MIC also operates a mobile laser peening unit which enables us to bring this technology directly to our customers on site.
MIC MARKETS INCLUDE:
- Aerospace
- Architectural
- Automotive
- Chemical & food processing
- General & structural engineering
- Marine
- Medical
- Military
- Off-road & earth moving equipment
- Oil, gas & petrochemical
- Power generation
- Railways

MIC SERVICES INCLUDE:
- Controlled shot peening
  induces engineered residual compressive stresses
- Shot peen forming
  creates curvature and corrects distortion
- Laser peening
  induces deeper residual compressive stresses
- Engineered coatings
  improves performance, prevents corrosion and aids lubricity
- C.A.S.E. (isotropic finishing)
  removes surface asperities reducing friction
- On-site processing
  provides services on customers’ own premises
- Peentex (architectural finishing)
  creates decorative and aesthetic texturing
- Surface texturing
  applies a textured engineered finish
- Peenflex mouldings
  protects against processing and handling damage