

INNOVATORS IN  
TECHNOLOGY

技术的创新者



**Metal Improvement  
Company**

Subsidiary of Curtiss-Wright Corporation

金属改进公司

# Aerospace applications

航空领域里的应用



Metal Improvement Company  
is a subsidiary of Curtiss-Wright  
Corporation

MIC是Curtiss-Wright集团旗  
下的子公司

Enhancing the performance of metals  
and materials

改善零件性能 延长零件寿命



# Aerospace applications

## 航空领域里的应用

Metal Improvement Company (MIC), established in 1945, is a global organisation specialising in metal and material treatment services which enhance performance and extend the life of critical components, prevent premature failures and enable component designs to achieve their maximum performance.

MIC has over 60 operating divisions in USA, Canada, Europe and Asia and can provide on site processing worldwide.

MIC's markets include aerospace, automotive, power generation, chemical processing, oil and gas, medical and general engineering.

Approvals: FAA, CAA, NADCAP and BS EN ISO 9001:2000 plus other specific company/industry approvals as appropriate.

成立于一九四五年的MIC是一家专门从事金属表面处理和提供相关服务的全球性公司，其服务能改善关键零件的性能和延长它们的寿命，并能防止零件早期失效，使这些零件达到其最大的设计潜能。

MIC在美国、加拿大、欧洲及亚洲设有60多家分公司，并能在世界任何地方提供现场加工服务。

MIC的市场包括航空、汽车、发电、化工、石油及天然气、医疗及一般工程领域。

所获得的认证有：FAA, CAA, NADCAP, BS EN ISO 9001:2000, 以及其它公司及行业认证。



### The aerospace industry

The aerospace industry demands high performance from lightweight materials capable of withstanding extreme loads often in an aggressive environment. Surface treatments can extend these performance characteristics by protecting the surface from external damage and extending the cyclic performance.

### CONTROLLED SHOT PEENING

Controlled shot peening is generally a cold working process where the component's surface is bombarded with small spherical particles to yield the base material, relieving prior manufacturing stresses and inducing residual compressive stresses tailored to suit the base material and application. The applied stress is reduced, enabling better dynamic performance and damage tolerance.

### SUPERFINISHING

Superfinishing of components is critical in applications of metal to metal contact such as gears and bearings. Generally applied after the controlled shot peening process to remove surface asperities resulting in reduced wear, macro and/or micro-pitting, noise and operating temperatures.

### SHOT PEEN FORMING

Shot peen forming is the preferred method of forming complex aerodynamic contours. This dieless process is ideal for forming wing skins and empennage panels. An extension of this approach will also correct complex parts distorted during machining and/or heat treatment.

### LASER PEENING

Laser peening can introduce residual compressive stresses in all metallic materials up to 5 to 10 times deeper than other conventional cold working techniques with virtually no surface damage. This clean and extremely controllable process is a production tool of significant benefit where product performance is critical.

### 航空工业

航空工业对其零件有很高的要求，不但要求零件材料轻，而且要求它们能够在极其恶劣的环境下承受极端的载荷。借助于保护零件表面免遭外部破坏以及延长疲劳寿命，我们的表面处理可以改善零件的整体性能。

### 精控喷丸

精控喷丸是一种冷处理工艺，工件表面在小的圆形球体的打击下产生屈服，在释放原有的残余应力同时，根据所处理的材料不同产生一定残余挤压应力。这种积压应力能够降低工作应力，获得较好的功能特性。

### 超精表面处理

对像齿轮和轴承这样一些相互摩擦的零件，对其表面进行超精处理十分重要。这种处理通常在喷丸后进行。经处理的零件表面微观粗糙度得到改善，从而可以降低磨损，微划伤，噪音及工作温度。

### 喷丸成型

喷丸成型是一种形成复杂的空气动力曲线较好的方法。这种无模工艺对飞机机翼的成型是最理想的。这种工艺还可用来去除复杂零件由于机加工或热处理产生的扭曲变形。

### 激光喷丸

激光喷丸的优势是能够在任何材料表层植入比传统冷加工技术深5到10倍的残余挤压应力，并且对所处理的表面丝毫不损。由于激光喷丸是一种清洁且控制度极高的工艺，所以它对于那些非常关键的产品十分有用。



### COATINGS

Selection of the appropriate coating can enable the use of less expensive materials, improve part life and reduce maintenance costs. MIC provides solid film lubricants that protect against adverse operating conditions, impingement coatings for an ultra thin surface, conformal coatings for sealing delicate objects and shielding coatings for electronic devices.

### HEAT TREATMENT

MIC specialises in the thermal processing of metallic components to relieve stresses, improve overall strength, ductility and hardness. This includes techniques of vacuum heat treatment, induction hardening, isothermal annealing, atmosphere normalising, carburising, carbonitriding and ferritic nitro carburising.



### 涂料

选择好合适的涂料可以减少对昂贵材料的使用，改善零件寿命，降低维护成本。MIC的硬膜润滑涂料能对不利工作环境提供保护，冲击涂料可形成超薄涂层，融合涂料可封闭精细的零件，以及针对一些电子零件的屏蔽涂料。

### 热处理

MIC专业热处理工艺能使金属零件释放应力，改善整体强度、延展性及硬度。有关工艺包括真空热处理、感应硬化、恒温回火、常温时效、炭化、氮化等。

## APPLICATIONS

Most metallic components used by the aerospace industry, whether for airframe, aero-engine, undercarriage, actuator systems or transmission components (gears for example) use key surface treatments to meet critical material performance targets.

These treatments have undergone laboratory and field testing to ensure reliability in extreme conditions to deal with the following material failure modes:

**Fatigue** - the initiation and growth of cracks can be controlled by the tailored application of sustainable residual compressive stresses.

**Fretting** - fretting damage potentially leading to fretting fatigue, can be minimised by the protection of the base materials with appropriate coatings and/or altering mating surface contact points and deep residual compressive stresses.

**Galling** - the adhesion of opposing surfaces when in contact, can be minimised by a coating protection and/or changes in material properties in the near surface area.

**Stress corrosion cracking** - the removal of surface tensile stresses or reducing them below threshold levels, can eliminate stress corrosion cracking.

**Corrosion** - protection of the surface by coating and, where fatigue can result, in combination with deep residual compressive stresses are both essential to minimise this problem.

**Wear** - wear can be lessened by reducing friction characteristics and/or increasing or altering mating hardness.

## 应用场合

航空工业使用的绝大多数零件，不管是飞机骨架，还是发动机、起落架、驱动装置、或传动零件（例如齿轮），均采用表面处理技术满足其材料的性能指标。

这些处理已经经历了各种各样的实验室和现场测试，以保证在各种极端条件以及失效模式下的可靠性。

**疲劳** - 借助于植入相当程度的挤压应力可以有效控制疲劳裂纹的产生及扩展。

**微磨损** - 微磨损会导致疲劳破坏，合适的涂料或喷丸能改善零件的表面接触和在表面产生挤压应力，从而大大降低微磨损的可能。

**咬合** - 涂料的保护或通过改变表面材料特性能有效防止相近零件表面的咬合。

**应力腐蚀裂纹** - 减少表面拉伸应力或使之降低到临界点以下将能消除应力腐蚀裂纹的产生。

**磨损** - 借助降低摩擦和增加相互接触零件的表面硬度可以减轻磨损。







## **Metal Improvement Company**

Subsidiary of Curtiss-Wright Corporation

**金属改进公司**

PLEASE CONTACT US:

请联系中国公司：

### **China Division**

**Metal Improvement Company Technology Services (Suzhou) Ltd**  
Jiangpu Road 75, Shengpu Township, Suzhou 215126, Jiangsu, China

Mob: +86 158 6241 7890

Email: richard\_chen@metalimprovement.com

麦锡金属改进技术服务(苏州)有限公司  
中国江苏苏州工业园区江浦路75号

移动电话：+86 158 6241 7890

电子邮件：richard\_chen@metalimprovement.com

**[www.metalimprovement.net.cn](http://www.metalimprovement.net.cn)**

---

### **European Office**

欧洲办公室：

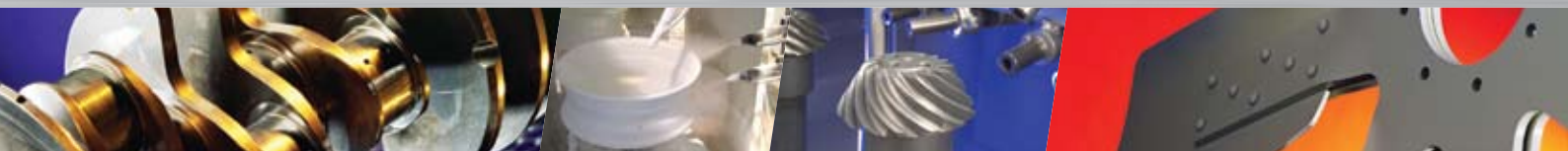
**Metal Improvement Company, LLC**  
European Corporate Office, Hambridge Lane, Newbury, Berkshire RG14 5TU, UK

Tel: +44 1635 279621

Mob: +44 7860 373064

Email: peter\_ohara@metalimprovement.com

**[www.metalimprovement.com](http://www.metalimprovement.com)**



SHOT PEENING ■ SHOT PEEN FORMING ■ LASER PEENING ■ COATINGS ■ HEAT TREATMENT

喷丸 ■ 喷丸成形 ■ 激光喷丸 ■ 喷涂 ■ 热处理