

**ACCELERATED TESTING and TREATMENT of  
HI-TECH COMPONENTS AND PRODUCTS  
Using HIGH-POWER ULTRASONICS**

High Power ultrasonics is offer a wide range of opportunities to assist in rapid testing and surface treatment of components and assembled systems. Some examples include:

- Accelerated 3-D Shock / Vibration test with Ultrasonic SHOT PEENING
- Accelerated Surface Treatment with Ultrasonic SHOOT PEENING
- Accelerated leakage and sealing test in liquid ULTRASONIC BATH
- Accelerated humidity resistance, corrosive resistance, or salt resistance using an ULTRASONIC VAPOR chamber

Applications: Hi-Tech, Watch-Industry, Microelectronics, Micromechanics, Military, Aerospace, Medical, Surgical Components and implants, etc.

All of above mentioned tests and treatments could be realized in a specially designed ultrasonically vibrating chamber (preliminary prototype available for presentation).

**Accelerated 3-D Shock / Vibration test with Ultrasonic SHOT PEENING:**

Small stainless steel balls in a specially designed ultrasonic chamber will be mechanically stimulated to impact parts placed in the chamber. The part is randomly and uniformly impacted in 3-dimensions by the steel balls with sufficient force to create a wide range of stresses. Some applications include

- Ultrasonically accelerated mechanical and structural stability testing (of Watches, Micro-systems and Hi-Tech components).
- Accelerated bolt unscrewing test (Watch industry, Micro-Systems).

For the companies involved in the production of high tech micro-electronic and micro-mechanic components and systems it would be valuable to have a testing tools that can give rapid answer about mechanical reliability. It is possible that such mechanical bombardment is able to simulate in just minutes of testing results equivalent to several weeks or months of testing using traditional testing methods.

This is particularly interesting in the R&D phase of new products when it is extremely profitable to have such accelerated testing possibilities. Immediate feedback about certain product elements would significantly impact future exploitation and product reliability. Normally products are given to specialized laboratories for testing for weeks or months of testing while the R&D team waits for positive or negative results. With accelerated testing important product and design improvements can be quickly analyzed and implemented to improve time to market and improve product reliability.

In one implementation the piece to be tested is hanging in the middle of ultrasonic chamber. Small metal balls (introduced in the same chamber) are randomly scattering and bouncing inside of the chamber, realizing uniform 3-D bombardment of the hanging solid piece (watch case, micro-mechanical system, high-tech component). A few minute of such treatment may correspond to more than a week of traditional 3-D vibrational and shock testing.

## **Accelerated Surface Hardening and Stress Release Without Heating using Ultrasonic SHOOT PEENING:**

The shot peening process is based on the effect of introducing compressive stresses in the surface of a metal part by controlled impinging with spherical particles. By this the resistance against fatigue will be increased and therefore also the life of a part. In the space and aircraft-industries the advantages of the shot peening process are already known: the increase of the fatigue-life of critical parts without weight increase. We propose to use a specially designed ultrasonic chamber where the treated part is randomly and uniformly impacted in 3-dimensions. Some applications include:

- Watch-Industry parts, Various Micromechanics, Military Parts, Aerospace Parts, Medical Parts, Surgical Components and Implants

Some of the known beneficial effects that can result due to high power peening treatment are:

1. Formation of a white layer up to 10 microns in depth with exceptional corrosion resistance, abrasion resistance, and lubricity.
2. Plastic deformation of the surface.
3. Elimination of tensile stress and the introduction of favorable compression stress up to 12 millimeters in depth.
4. Altering the surface finish resulting in a smoother surface and eliminating defects.
5. Improvement in endurance and corrosion resistance. Up to 250% and 400% respectively.

Shot peening is also used in applications where the effects of fatigue were caused by grinding, electrical discharge- and electrochemical-machining (EDM and ECM), electroplating, anodising, thermal spraying and welding. It also can help increase resistance to fretting, galling, cavitation erosion, stress-corrosion cracking, intergranular corrosion and hydrogen-embrittlement.

## **Ultrasonically accelerated surface coating with multi-component powders:**

Here again we also employ small stainless steel balls in a specially designed ultrasonic chamber that are mechanically stimulated to impact parts placed in the chamber. In this case we also include a powder substance that we wish to imbed into the surface of the treated part. The part is randomly and uniformly impacted in 3-dimensions by the steel balls and the powder with sufficient force to allow penetration of the powder into the surface of the part.

- Powders may include: Metal powders, Ceramic powders, Polymer powders, and combinations of such powders.
- Some applications include: Watch-Industry parts, Various Micromechanics, Military Parts, Aerospace Parts, Medical Parts, Surgical Components and Implants

## **MPI**

### **Accelerated Leakage & Sealing Test in a Liquid ULTRASONIC BATH:**

An ultrasonic chamber filled with water (or some other liquid) may be used for leak testing, sealing, and corrosion resistance tests on watchcases, high-tech components, or Microsystems.

### **Accelerated Humidity Resistance testing, Corrosive Resistance, and Salt Resistance testing in and ULTRASONIC VAPOR:**

An ultrasonic chamber filled with water vapor (or some other liquid vapor) may be used for humidity resistance testing, sealing, and corrosion resistance tests on watchcases, high-tech components, or Microsystems.