

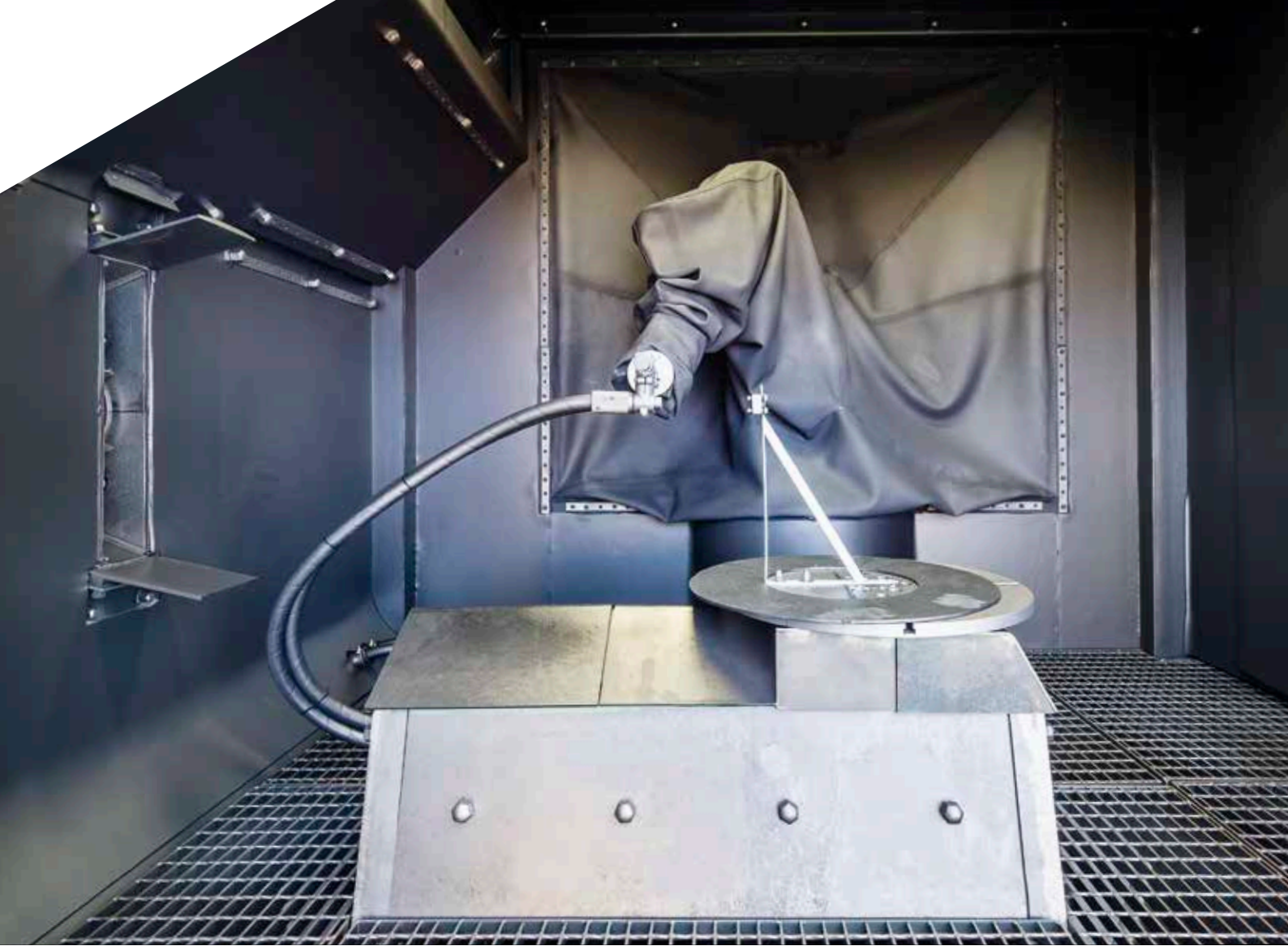


# MECHANICAL SURFACE TREATMENT

## Improving mechanical properties through compressive residual stresses

Dimensional control and performance specifications for metallic parts are increasingly strict meaning that processes, such as shot peening, need to be continuously improved. These processes must also be adapted to newly developed alloys.

Through the study and understanding of surface strengthening and damage mechanisms, including numerical simulation of residual stresses, IRT M2P improves existing processes and helps develop new ones. Experienced in the aerospace, automotive, marine and other sectors, IRT M2P deploys its industrial-scale equipment and know-how in the field of shot peening and mechanical surface treatments.



## EXPERTISE & SERVICES

### Mechanical surface strengthening

- Access to a flexible platform equipped with various sensors
- New shot development
- Process development and optimization
- R&D and industrial support for shot peening
- Adaptation of shot peening parameters with respect to product specifications
- Assistance with integrating shot peening with other processes
- Robot trajectory programming and evaluation of effective zone

### Process supervision

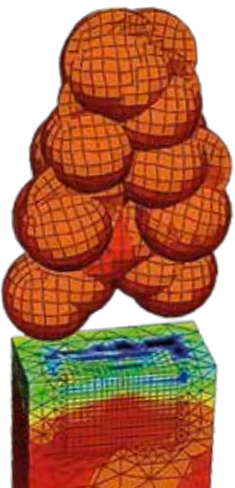
- Automotive and aerospace standards
- Precise determination of Almen intensity and covering ratio
- Pressure and mass flow monitoring
- Shot speed monitoring by Shotmeter®

### Process simulation and modelling

- Part design including shot peening
- Predict residual stresses under solicitation
- Parametric studies and model definition
- Process simulation using a multi-shot model: projectile speed, angle, shot size, covering ratio, material characteristics

### Analysis & Characterization

- Surface integrity
- Residual stresses analysis
- Mechanical properties
- Microhardness profile



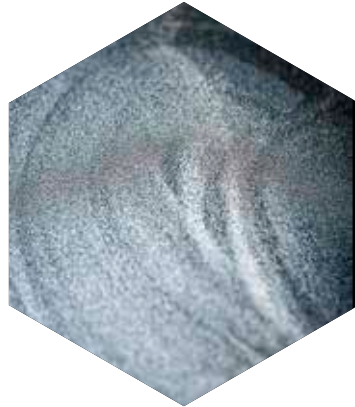
## TECHNOLOGY

### Shot peening process by:

- Nozzles: Precise and controlled application including difficult-to-reach zones
- Turbine: High intensity, adapted for full-scale production
- Specially designed tool to project shot within bores (turbine rotor, pipes/tubes, etc.)

### Laser Shock Peening

- No surface contamination (in situ operation, no post treatment, etc.)
- Deeper and more intense residual stresses profiles
- Precise treatment zones
- Laser via optical fiber or air



## APPLICATIONS

- Use of design-of-experiments to optimize shot peening parameters for titanium alloys in order to maximize fatigue enhancement and strike a balance between residual stresses and surface integrity
- Impact of shot peening on maraging alloys and process optimization
- Laser shock peening for in situ repairs
- Examples: Bearings, springs, wheels, landing systems, turbine disks and blades, Weld seams, etc.



## EQUIPMENT @M2P

### SHOT PEENING PLATFORM

- 2 shot peening machines
- 6 axis robot
- Nozzle diameters: 4, 10 and 20 mm
- Bore stick: 1 800 mm
- Rotating table
- Shot sieving and separating
- Wide selection of shot: Cast steel, Cut wire, ceramics
- Monitoring
  - Shot speed (Shotmeter®)
  - Offline robot trajectory
  - Pressure and mass flow

### LASER SHOCK PEENING PLATFORM

- 6 axis robot
- Laser beam: 1 J to 1064 nm
- Pulses: 5 to 20 ns
- Water containment, or other
- 5 m long optical fiber
- Optical fiber cleanliness monitoring during use

# RELATED ACTIVITIES

## HEAT & THERMOCHEMICAL TREATMENT

Thermochemical treatment association with shot peening to improve the fatigue life.



## ANALYSIS & CHARACTERIZATION

Surface integrity evaluation, deformation tracking induced by residual stresses introduction and fatigue tests.



### About IRT M2P

The Institute of Research and Technology for Materials, Metallurgy & Processes (IRT M2P) is your partner for developing innovative products and processes to accelerate your company's growth.

We bring our expertise, a wide array of state-of-the-art semi-industrial technological platforms and a network of academic labs to the R&D projects we carry out with our more than 120 industrial partners.

### Working together

- Multi-partner research projects with private/public co-funding
- Private research studies, tailor-made services
- Small series & prototype production
- Training

Contact us to discover our 9 areas of technological expertise:

- > Advanced Foundry
- > Life Cycle Assessment & Recycling
- > Metal Powders
- > Surface Treatment & Coatings
- > Mechanical Surface Treatment
- > Heat & Thermochemical Treatment
- > Composite Materials
- > Multimaterials Joining
- > Analysis & Characterization



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