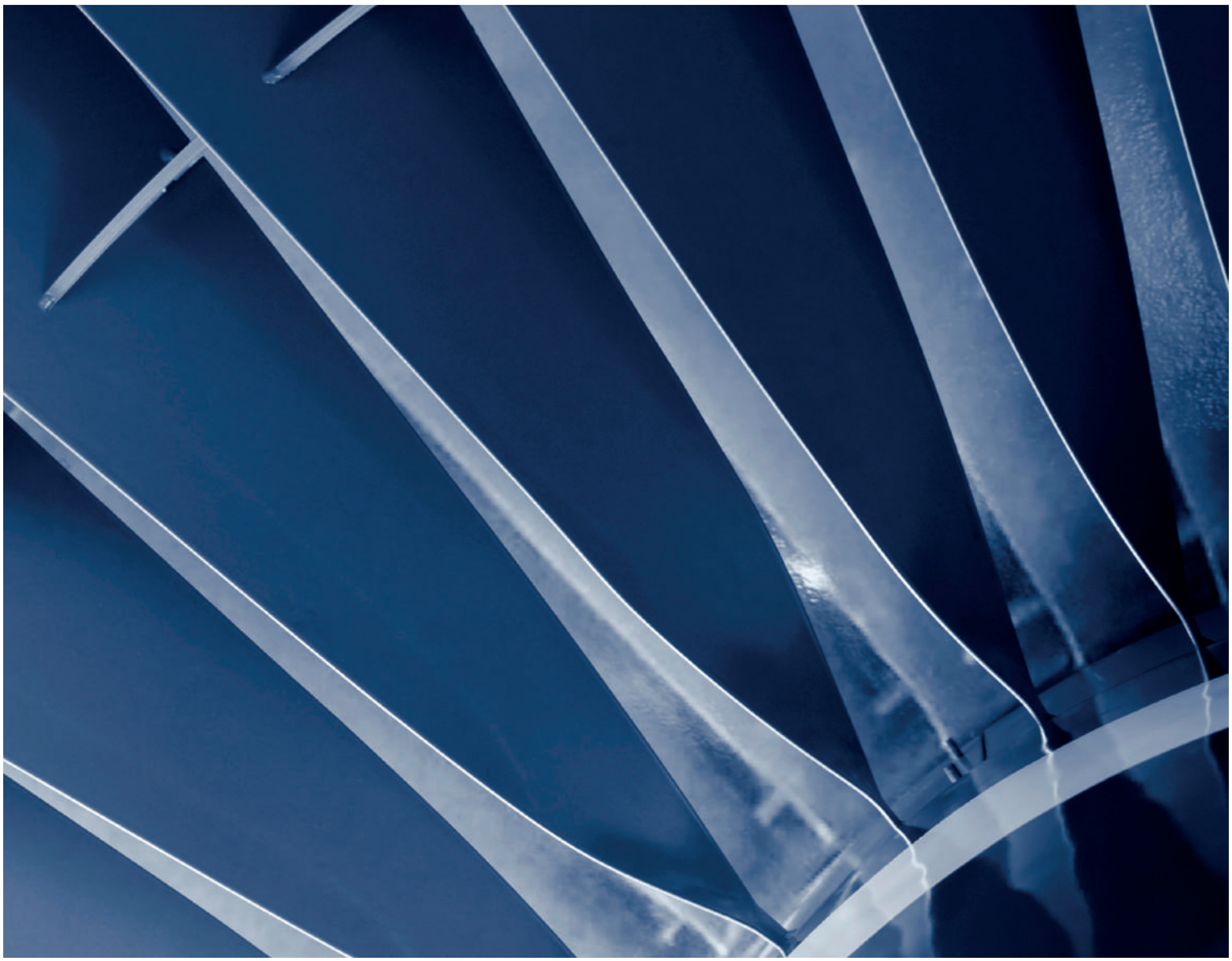
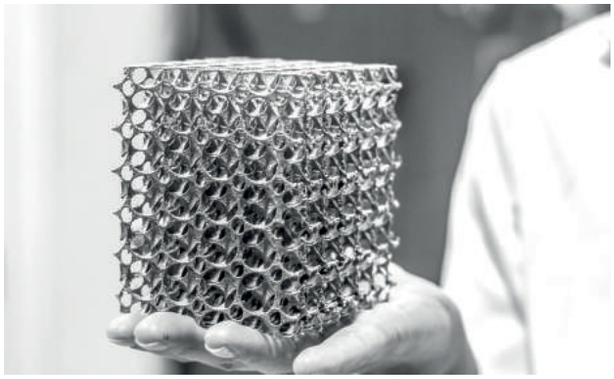
Quintus
TECHNOLOGIES

Hot Isostatic Pressing

Supporting the Additive Manufacturing Industry



Supporting Additive Manufacturing



Common applications include:
- Defect healing of AM parts (pore elimination)
- Consolidation of powder metal and ceramic parts
- Diffusion bonding

HIP is expanding into new applications such as:
- Automotive and Aerospace
- HIPing of large volumes
- Material heat treatment by quenching
- Stress relief by temperature and pressure
- Metal injection molded parts

Stacking of titanium turbine blades

Photo courtesy of AVIOPROP

Hot Isostatic Pressing (HIP) has been used successfully by manufacturers around the world. HIP is used to eliminate pores and remove defects, i.e. nitrides, oxides and carbides, to dramatically increase the material properties.

With typical pressures from 400 to 2,070 bar (5,800 to 30,000 psi) and temperatures up to 2,000°C (3,632°F), HIP can achieve 100% of maximum theoretical density and improve the ductility and fatigue resistance of critical, high-performance materials. The components from 3D-printing, regardless of method (EBM, SLM, etc.), benefits greatly from HIPing.

A proven process for additive manufacturing parts
Common applications for hot isostatic pressing include defect healing of AM parts (pore elimination), consolidation of Titanium powder and diffusion bonding of dissimilar metals or alloys. The technology is expanding into new applications for Aerospace applications as well as heat treatment.

Why you should HIP:

~100% of theoretical density
- Longer life time
- Predictive life time
- Lighter and/or low weight designs

Improved material properties
- Increased mechanical properties e.g. fatigue, wear, abrasion and ductility
- Reduced property scatter
- Stress relief of AM parts

More efficient production vs. traditional manufacturing
- AM combined with HIP can reduce energy use up to 50%
- AM combined with HIP can reduce material costs up to 90%

HIP and Heat Treatment simultaneously

Quintus Uniform Rapid Cooling (URC™) and optional Uniform Rapid Quenching (URQ™) furnaces can provide decreased cycle time, higher productivity, and a unique HIP cycle that includes heat treatment. Benefits are reduced energy consumption, reduced costs, improved quality control and the material is ready for following production steps, i.e machining, polishing, etc.

Pore elimination gives dramatic effects of the fatigue life when it comes to stress levels and number of cycles before failure. Up to 10 times improvement can be achieved by HIPing in the right conditions.

Post treatment
By applying the right conditions in the HIP, post-treatment steps like in a stress relief furnace, the total cycle times can be shortened by 50%.

Improving parts for the aerospace industry
Of all the HIP installations in the world, more than 50% are utilized to consolidate and improve the material properties of Titanium and Super-alloys for the aerospace industry. Today HIP is the standard procedure to give longer and predictive life time of fan blades in an aircraft engine. Regardless of alloy system, or 3D printing method (EBM, SLM, etc.), HIP is the way forward for optimized material properties and cost savings for safe and efficient production with high quality.

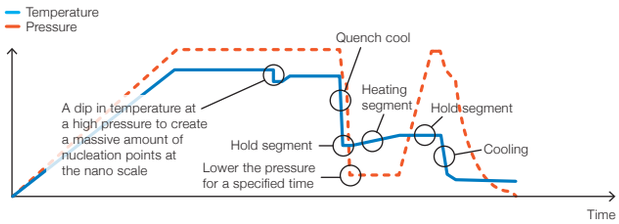
HIP quenching values:

Controlled cooling rates up to 3,000°C/min can be achieved by combining possibilities of pressure and temperature control that the URQ can offer:
- Heat treatment steps can be included into the HIP cycle
- Shortened lead time
- Process steps, like stress relief, can be removed from the usual process route to increase productivity and lower cost/kg

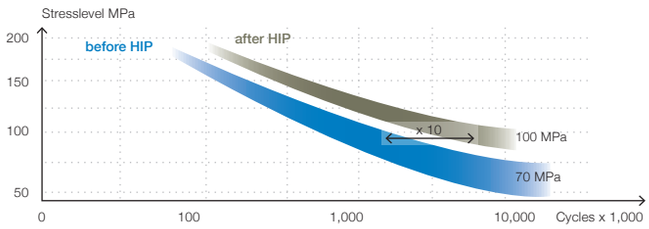
Benefits compared to conventional heat treatment methods:
- Programmable temperature distribution with good accuracy
- No distortion due to reduced thermal stresses
- No cleaning or drying of parts after quenching
- Reduced cracking

New and unique materials can be achieved
- Material optimization
- Improved fatigue and ductility
- Non-castable alloy compositions

URQ – Uniform Rapid Quenching with different pressures
Variable cooling and heating rates and pressure levels will make it possible to precisely control the quality and mechanical properties of treated parts. From work with Indexator AB at Quintus lab in Västerås, Sweden.



Improving parts for the aerospace industry
Courtesy of Bodycote



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The Global Leader in High Pressure Technology

Quintus Technologies specializes in the design, manufacture, installation, and support of high pressure systems for sheet metal forming and densification of advanced materials and critical industrial components. Headquartered in Västerås, Sweden, and represented in 35 countries worldwide, the company is the world leader in high pressure technology and has delivered more than 1,800 systems to customers across the globe within industries such as aerospace, automotive, energy, and medical implants.

Contact us: www.quintustechnologies.com · info@quintusteam.com

Quintus Technologies AB
Europe/Asia Sales
Quintusvägen 2
SE 721 66 Västerås, Sweden
Phone: +46 21 32 70 00
Fax: +46 21 14 18 17

Quintus Technologies LLC
US Sales
8270 Green Meadows Drive N
Lewis Center, Ohio 43035
Phone: +1 614 891 2732
Fax: +1 614 891 4568

Service & Support
Europe/Asia
T +46 21 32 73 00
support@quintusteam.se

Service & Support
US
T +1 614 891 2732
support@quintusteam.com

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