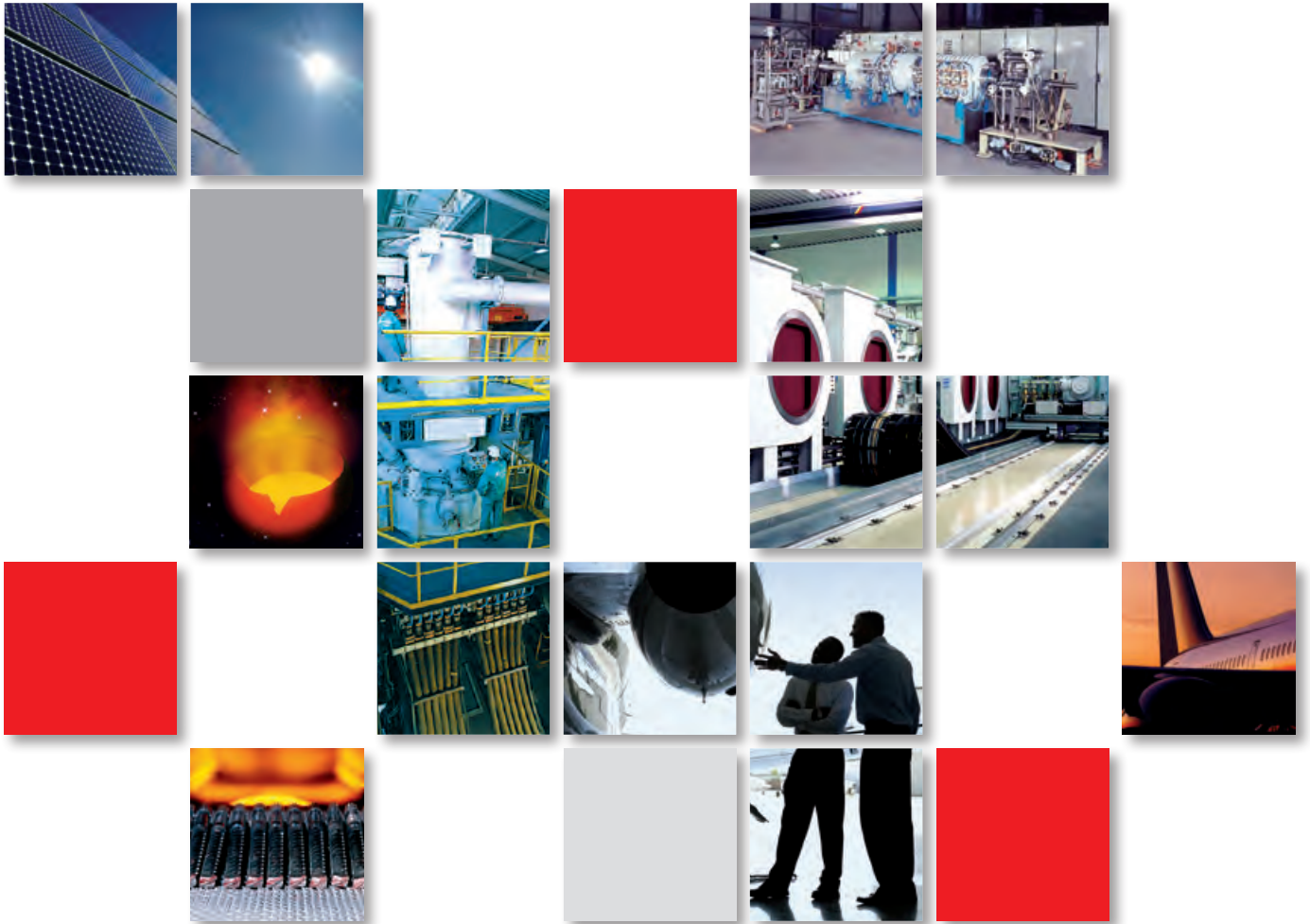


The Solution



## Vacuum Systems and Technologies for Metallurgy and Heat Treatment

# Know-How is our Business



ALD Vacuum Technologies supplies vacuum equipment and systems and offers process services for thermal and thermo chemical treatment of metals in solid and liquid form. Our expertise is vacuum process technology as well as know-how in designing customized system solutions.

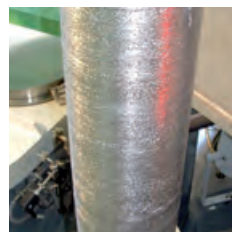
ALD's reputation is based on application of its superb know-how and high investment in research and development. Close cooperation and collaboration with well-known manufacturers has strengthened our position as a supplier of key technologies to major growth markets.

## **Vacuum Metallurgy**

Vacuum metallurgy involves the design and supply of systems and processes for treating metals in liquid form – particularly vacuum systems for the melting, remelting and casting of metals and alloys, metals for solar cells, as well as special coating equipment for turbine blades.

## **Vacuum Heat Treatment**

Vacuum furnaces are used for the heat treatment of metals, such as tools, transmissions, high precision parts for engines and fuel injection systems. We also specialize in the sintering of high strength cemented carbides and special oxides.



# Vacuum Systems and Technologies ...

## New Vacuum Processing Developments for Metallurgy drive Future Technological Advances

Vacuum metallurgy is presently entering a new phase building on the experience gained from continuously refining established processes and developing new process combinations. Secondary vacuum processes such as steel degassing and ladle metallurgy, melting and remelting, as well as casting and metal-powder technology, have led to high quality metallurgical products tailored to meet the ever-increasing demands imposed upon them. New processes are being developed that will yield improved quality and efficiency as well as the opportunity to produce entirely new products.

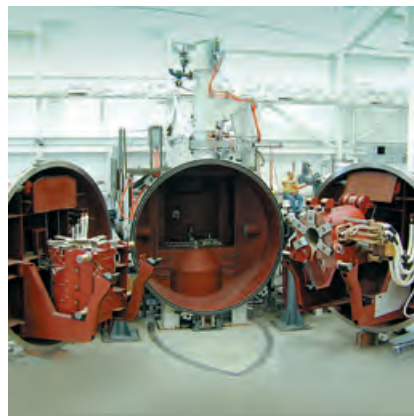
The use of these metalmaking processes in modern, efficiently functioning production systems reduces cost significantly. The recycling of waste from the processing of costly materials contributes to the cost-effectiveness of these processes.

Examples of the products that were derived from these technologies include highly alloyed special steels and superalloys, refractory and reactive metals with ultrahigh purity and a fine grain structure, precision castings with directional and single-crystal structures, forgings in near net shape and high purity powder for homogeneous, high strength parts.

High strength and reliability requirements add to demanding applications in the aviation industry, while high-purity products contribute to new developments in electronics and offshore energy applications. Each and every technology has its pros and cons, partially overlapping each other in their techno-economic potentials. Choosing the appropriate technology for these highly specialised tasks can only be solved by close cooperation between equipment supplier, producer and consumer. ALD is proud to master this challenge to the benefit of its contractors, manufacturers and customers.



▲ 20 t ESR furnace capable of melting under protective atmosphere



▲ Double-door crucible VIGA atomization unit for high quality metal powder



▲ SCU 400 / 800 Silicon melting and crystallization unit for PV grade ingot production



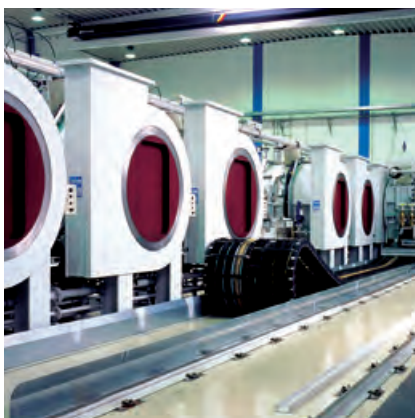
# ... for Metallurgy and Heat Treatment

## Hardening and Tempering, Brazing

Hardening is a metallurgical process used to increase the hardness of materials. Hardening of steels involves a controlled heating to austenitizing temperature with subsequent quenching and tempering – with the aim to improve strength and ductility properties of the material by influencing the microstructure. Brazing is a metal joining process where two different metal parts are joined together in a furnace by melting a filler metal in a small gap between the parts. Vacuum brazing offers significant advantages as it is extremely clean and produces flux-free braze joints of high integrity and strength.

## Case Hardening

Vacuum carburizing processes are used in the gear industry as well as for producing fuel injection systems to withstand high mechanical stress. Following the highly efficient vacuum carburizing step, the parts are quenched with inert gases under high pressure. This dry quenching method saves subsequent cleaning steps and reduces distortion of the quenched parts and therefore minimizes or eliminates cost intensive hard machining. The advantages of this new technology are both environmentally friendly and enable new manufacturing strategies which can reduce manufacturing costs.



▲ ModulTherm® furnace system for flexible mass production to vacuum case harden and heat treat a broad variety of steels

## Sintering

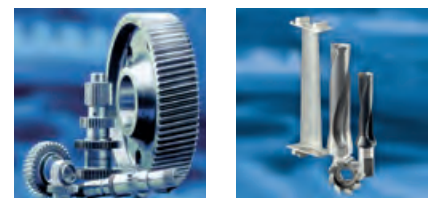
Sintering is a thermal process of making parts from a powder material by heating the material in a sintering furnace below its melting point. In the overpressure sintering process, the parts are firstly dewaxed in vacuum or an protected atmosphere before they are sintered in vacuum. To further reduce porosity Argon at a pressure of 60 to 100 bar is introduced after the vacuum sintering to ensure the material quality of high-performance hard metal tools and other sintered parts.



▲ Over pressure sintering furnace type VKPgr for up to 100 bar to sinter high grade cemented carbide parts

## Own & Operate

It is ALD's strategy to offer a full service package to its customers. ALD has developed customized heat treatment processes with its technologies, using furnaces built by ALD. This enables customers to minimize the learning curve and investment, keeping their part manufacturing operations updated with the latest developments and technology. ALD runs several heat treatment centres to process customer's parts.



▲ MonoTherm® furnaces in various designs for high flexible vacuum heat treatment and case hardening

# Our Delivery Program

## Vacuum Metallurgy

### Primary Melting

Vacuum Induction Melting and casting (VIM/VID/VIDP)

### Remelting

Electro Slag Remelting (ESR)

Vacuum Arc Remelting (VAR)

Electron Beam melting (EB)

### Casting and Coating

Vacuum Induction Melting – Investment Casting (MIM-IC)

Vacuum turbine blade coating (EB/PVD)

### Photovoltaic

Solar silicon melting and Crystallization Unit (SCU)

### Special Furnaces

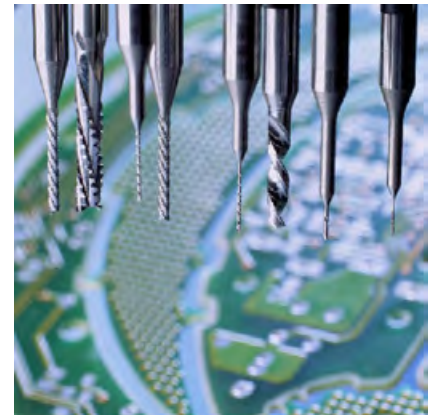
Hot Isothermal Forging (HIF)

Vacuum Induction melting Gas Atomizer (VIGA)

Electrode Induction melting Gas Atomizer (EIGA)

Induction heated Quartz tube furnace (IWQ)

High vacuum resistance furnace (WI)



## Vacuum Heat Treatment and Sintering

### Vacuum Hardening, Tempering

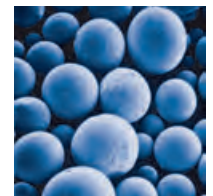
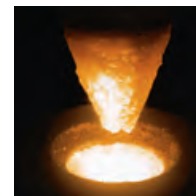
Vacuum heat treatment of tool steels and other metals in vertical and horizontal batch furnaces

### Vacuum Case Hardening

Vacuum carburizing and high pressure gas quenching in MonoTherm®, DualTherm®, ModulTherm® and SyncroTherm® furnaces

### Vacuum Sintering

Sintering in vacuum or under high pressure (HIP) up to 100 bar



## Own & Operate

Service to customers with selected technologies to process customer's parts in own subsidiaries

## Nuclear Activities

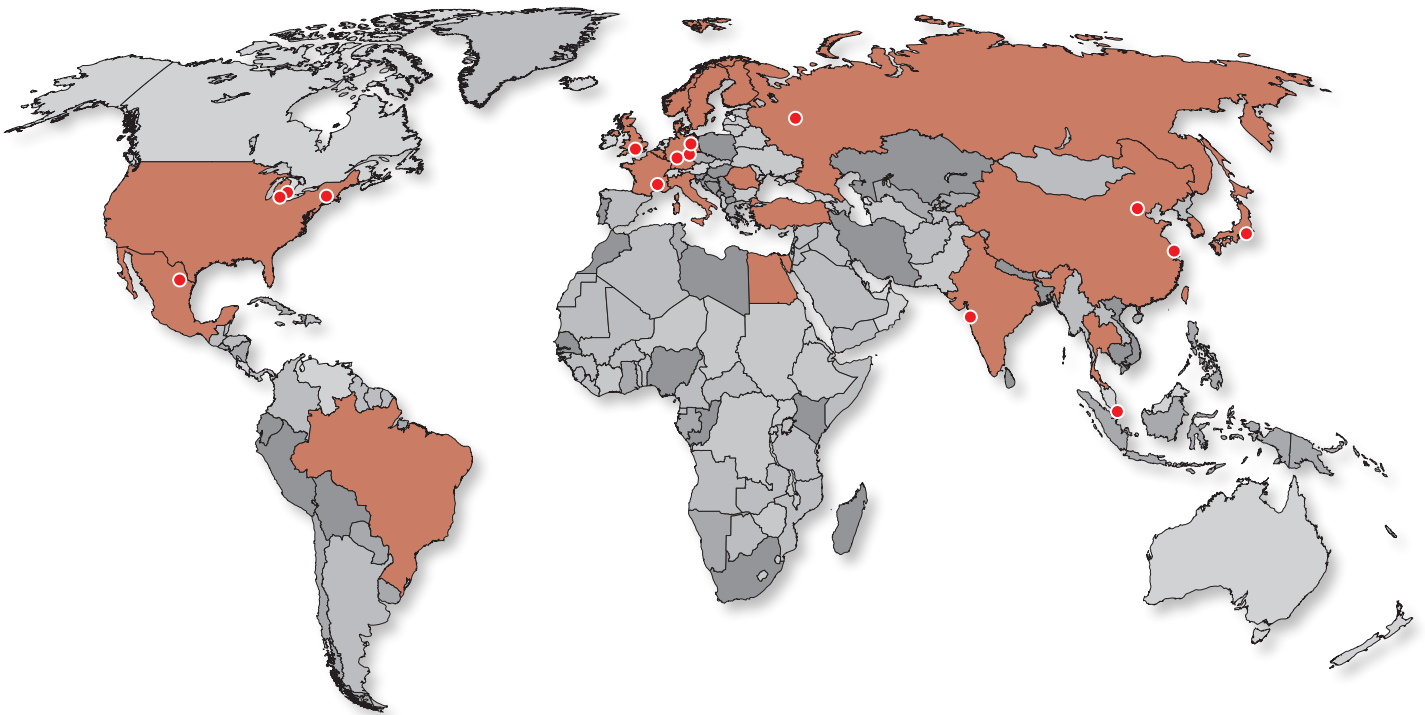
Furnaces, engineering, services and process technologies provided by our subsidiary FNAG Furnaces Nuclear Applications Grenoble





# ALD Vacuum Technologies Worldwide

ALD Vacuum Technologies in Hanau, Germany, is the leading global supplier of process technologies, furnaces and services in the field of vacuum metallurgy and vacuum heat treatment. With subsidiaries in the USA, Japan, the UK, Russia, China, India, Mexico, France, Singapore and more than 70 representative offices, ALD is a world-wide supplier to industries e.g. power generation, environment, aviation, photovoltaic and automotive suppliers.



ALD Vacuum Technologies GmbH is represented worldwide.  
You find our nearest representative office at [www.ald-vt.de](http://www.ald-vt.de)

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