

ALD Vacuum Technologies

High Tech is our Business

WORLD CLASS EQUIPMENT SOLUTIONS

FOR METALLURGY AND HEAT TREATMENT





Worldwide Leading

Our Market Position

ALD Vacuum Technologies is the market leader in vacuum systems and process services for thermal and thermo-chemical treatment of solid and molten metals.



Our Process and Equipment Portfolio

Our engineering expertise includes

- ▶ vacuum process technology
- ▶ know-how to design customized system solutions for

Vacuum Metallurgy

Vacuum Heat Treatment and Sintering

Nuclear Fuel Production and Waste Management



Vacuum Metallurgy

Our vacuum metallurgy portfolio involves vacuum processes and systems for treating molten metals, such as melting and remelting, casting and metal powder production furnaces and technologies as well as specialized vacuum coating processes for high temperature turbine components.



Applications

Examples of products that were developed using ALD's advanced vacuum processes include

- ▶ highly alloyed special steels and superalloys
- ▶ refractory and reactive metals with ultrahigh purity
- ▶ fine-grain precision castings with directional and single-crystal structures
- ▶ forgings with near net shape
- ▶ semiconductors for solar cells
- ▶ high purity powder for homogeneous and high strength parts
- ▶ additive manufacturing
- ▶ plasma spray coatings

System Portfolio

ALD offers modern, state-of-the-art production systems which

- ▶ significantly contribute to the cost-effectiveness of a high quality production
- ▶ cover the complete range of sophisticated metal making processes

Primary Melting & Secondary Remelting

- ▶ Vacuum Induction Melting and Casting (VIM/VID/VIDP)
- ▶ Electro Slag Remelting (ESR)
- ▶ Vacuum Arc Remelting (VAR)
- ▶ Electron Beam Melting (EB-CHR)
- ▶ Plasma Melting (PAM-CHR)

Casting & Coating

- ▶ Vacuum Induction Melting – Investment Casting (VIM-IC)
- ▶ Cold-Wall Induction Melting and Casting (LEICOMELT)
- ▶ VAR Skull Melting and Casting (VAR-SM)
- ▶ Vacuum Turbine Blade Coating (EB/PVD)

Photovoltaic

- ▶ Solar silicon melting and Crystallization Unit (SCU)

Powder Atomization & Additive Manufacturing

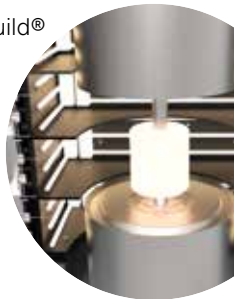
- ▶ Vacuum Induction Melting Gas Atomizer (VIGA)
- ▶ Electrode Induction Melting Gas Atomizer (EIGA)
- ▶ Electron Beam Powder Bed Fusion (EB-PBF) - EBuild®

Special Furnaces

- ▶ Hot Isothermal Forging (HIF)
- ▶ Induction Heated Quartz Tube Furnace (IWQ)
- ▶ High Vacuum Resistance Furnace (WI)

Turn-Key Solutions

Research & Development



Vacuum Heat Treatment, Sintering & Services

Vacuum heat treatment processes and furnaces of ALD are used whenever high performance properties are required for tools, transmissions, precision engine parts and fuel injection system components.



Process & Furnace Portfolio

Vacuum hardening, tempering and brazing of

- ▶ tool steels and other metals, in vertical or horizontal batch furnaces

Vacuum carburizing and high pressure gas quenching furnaces from ALD

- ▶ MonoTherm® for aerospace applications
- ▶ DualTherm® for multipurpose applications
- ▶ ModulTherm® for modular and flexible heat treatment in large scale-production
- ▶ SyncroTherm® for full integration in the manufacturing line

They all feature dry, high pressure gas quenching which

- ▶ saves subsequent cleaning steps
- ▶ reduces distortion of the quenched parts
- ▶ minimizes or eliminates costly hard surface machining

Vacuum sintering furnaces for

- ▶ sintering, high-strength cemented carbides and special oxides
- ▶ vacuum or high pressure (HIP) up to 100 bar

Vacuum nitriding furnaces for

- ▶ gas nitriding processes in NitroTherm® furnaces
- ▶ active screen plasma nitriding (ASPN) processes using the ION₂-cloud® technology

Heat Treatment Services

ALD's heat treatment centers offer heat treatment services for customers using furnace and process technology developed by ALD. This enables customers to

- ▶ minimize the learning curve, startup costs and equipment investment
- ▶ keep their manufacturing operations updated with the latest developments and technology

Engineering Services

ALD's own competence center offers customized Development & Engineering Services



Nuclear Fuel Production & Waste Management

ALD's modular pusher type sintering furnaces are used for the production of nuclear fuel pellets such as UO₂ and MOX. ALD also offers solutions for volume reduction, decontamination and for recycling contaminated metal scrap.

The company developed an Impermeable Graphite Matrix (IGM) as a method to embed contaminated radioactive graphite waste materials to ensure a safe isolation from the biosphere for millions of years.

Our Reputation

ALD's reputation is based on application of our extensive know-how and long-term investments in research and development, which have led to high quality systems tailored to meet ever-increasing demands.

Our Markets

Close cooperation and collaboration with well-known manufacturers have strengthened our capabilities as a supplier of key technologies to demanding high tech markets.

- ▶ High strength and at the same time long-term reliability are typical for demanding applications in the aviation, automotive and power generation industry.
- ▶ High purity products are needed for new developments in electronics, offshore and photovoltaic energy production.

Our Expertise

New processes are continuously being developed that will yield improved quality, efficiency and the opportunity to produce entirely new materials. Each of these unique technologies offers different benefits, partially overlapping each other in their technical and economic potentials.

ALD has the experience and expertise to work in close cooperation with its customers to select and customize the appropriate process and equipment technology for their highly specialized applications.



INVESTMENT CASTING



THERMAL BARRIER COATING



VACUUM INDUCTION MELTING



ADDITIVE MANUFACTURING



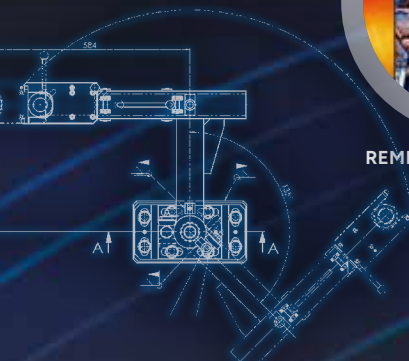
REMELTING & REFINING



VACUUM HEAT TREATMENT



POWDER ATOMIZATION





ALD – Leading Supplier for Advanced Vacuum Furnaces

Being one of the leading suppliers of vacuum plants and process technology we supply the entire vacuum metallurgy and vacuum heat treatment sector with our high-tech products and processes. ALD offers individual solutions for the best economic performance. We offer worldwide support and maintenance service for our high-quality plants during their entire lifecycle. Each newly delivered ALD plant meets the latest digital standards and is characterized by a particularly high level of environmental compatibility.

150+ YEARS EXPERIENCE – A Young Company with History



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