WACKER: ESR PRESS CONFERENCE

ESR Technology | 2024

AMG ENGINEERING alp

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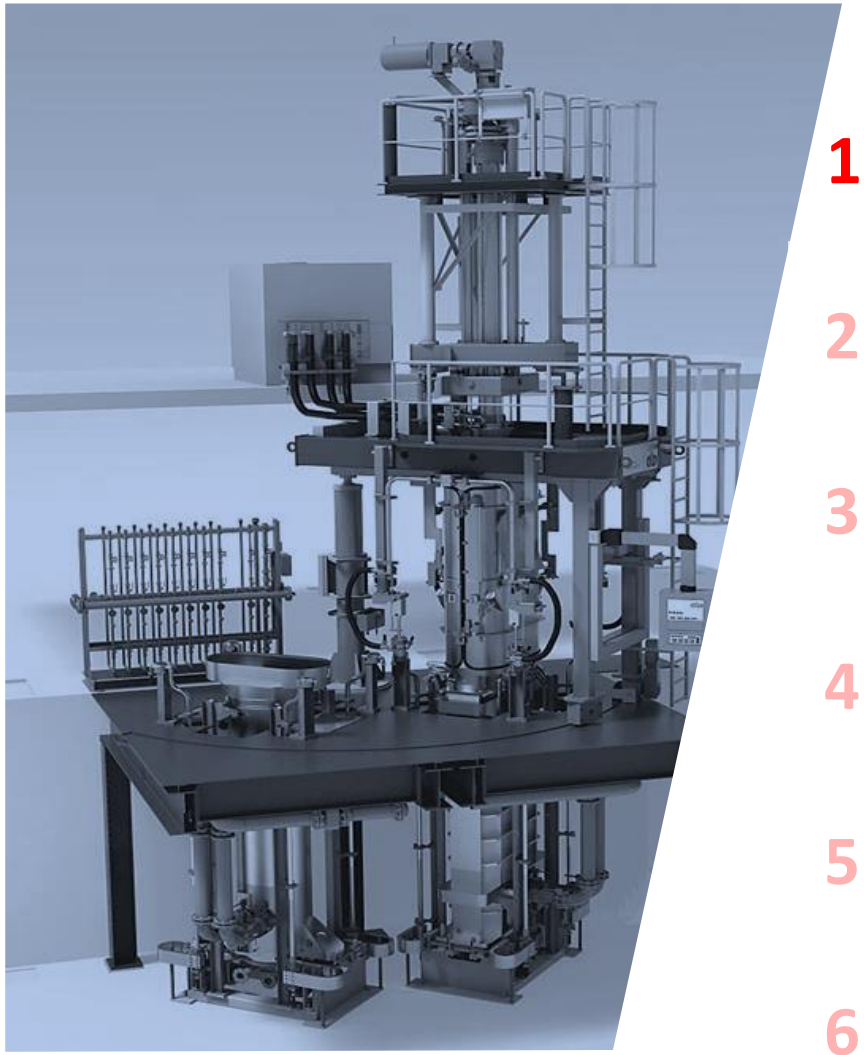
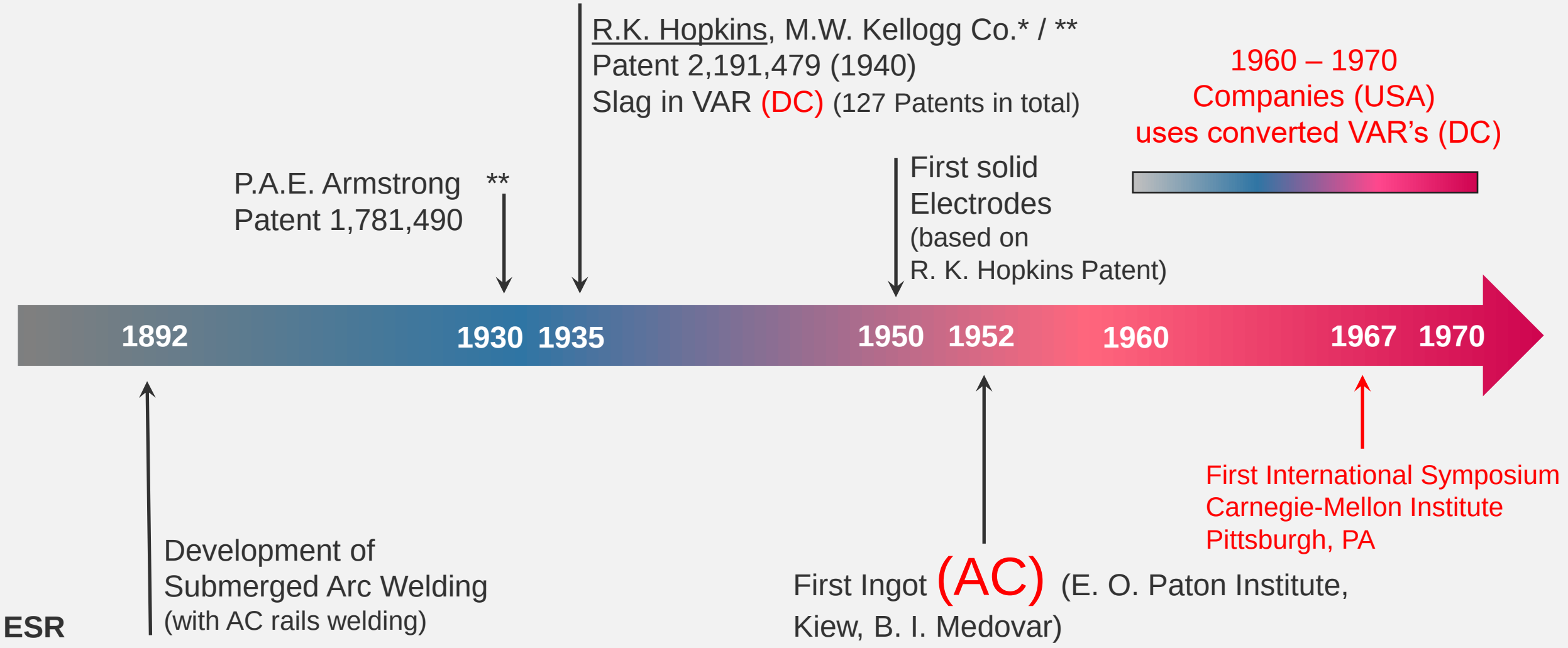
Outline of topics



ESR IN STATIONARY MOLDS - A BRIEF HISTORY OF ESR TECHNOLOGY

ESR - WHY IT BECAME SUCCESSFUL

* G. Hoyle, Electroslag Process Principle and Practice
** H.A. Johnson, G.K. Bhat, ESR Superalloys for Gas Turbine Engines

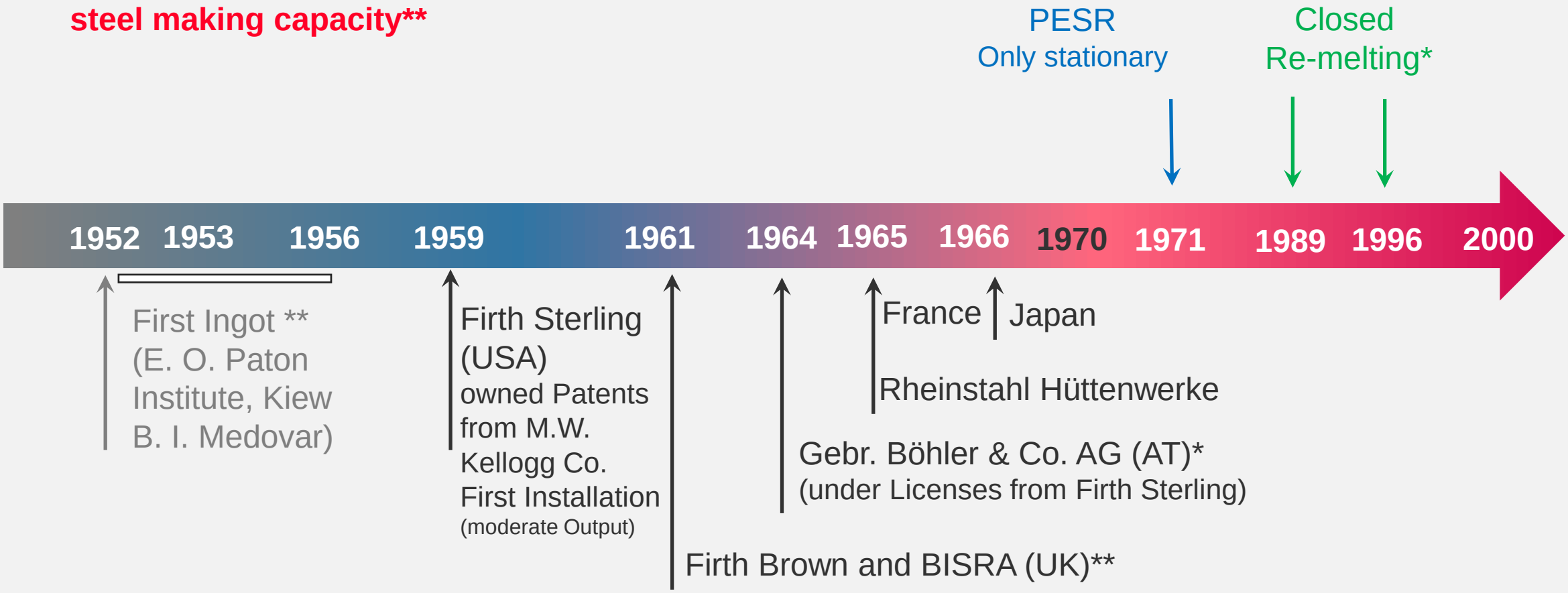


ESR IN STATIONARY MOLDS - A BRIEF HISTORY OF ESR TECHNOLOGY

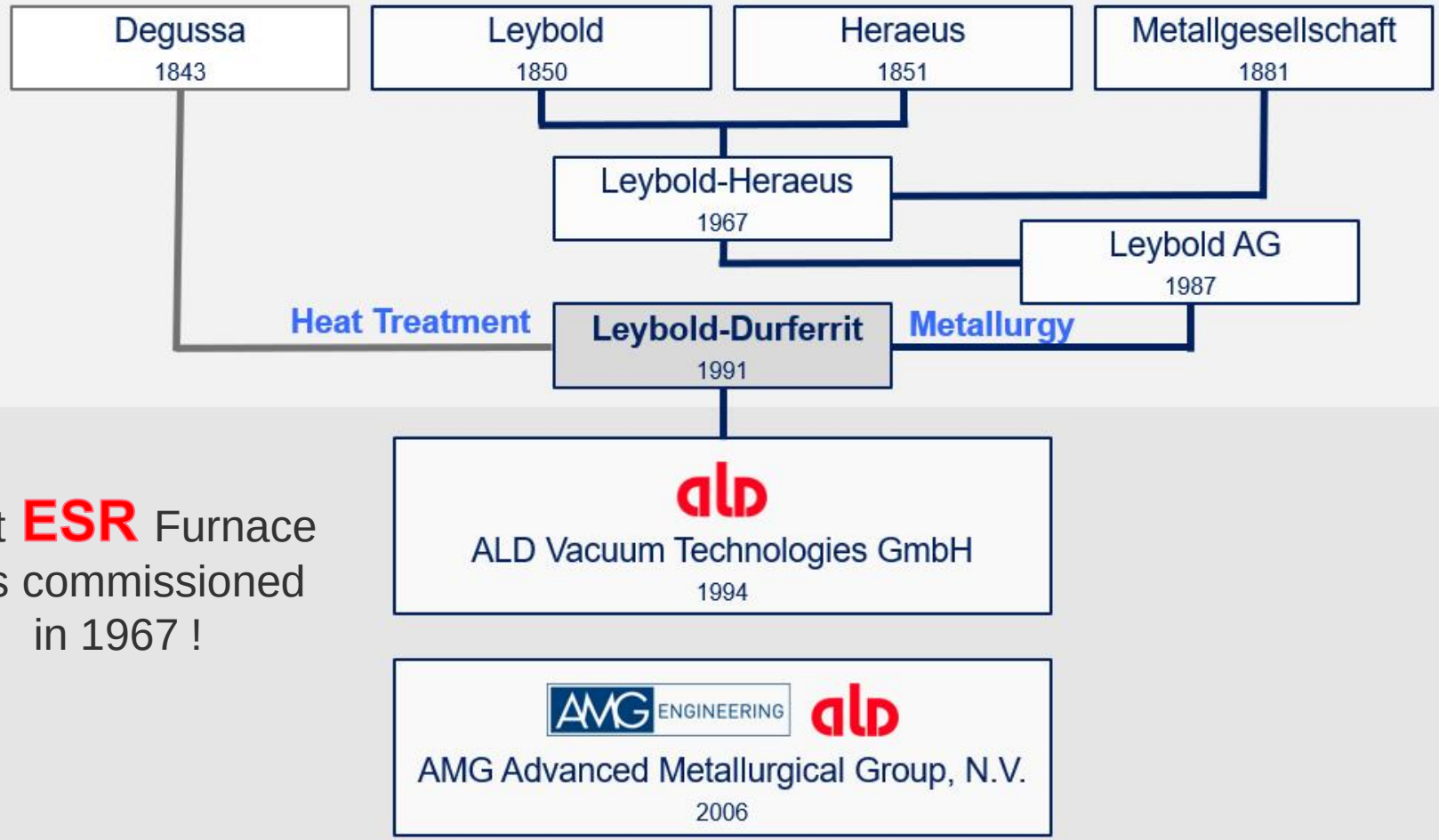
ESR - WHY IT BECAME SUCCESSFUL

* W. Holzgruber, Berg- und Hüttenmännische Monatshefte
** B. Paton et all; ESR in the Soviet Union, 1968 Brighton

1970:
ESR material 0.1% of world wide steel making capacity**



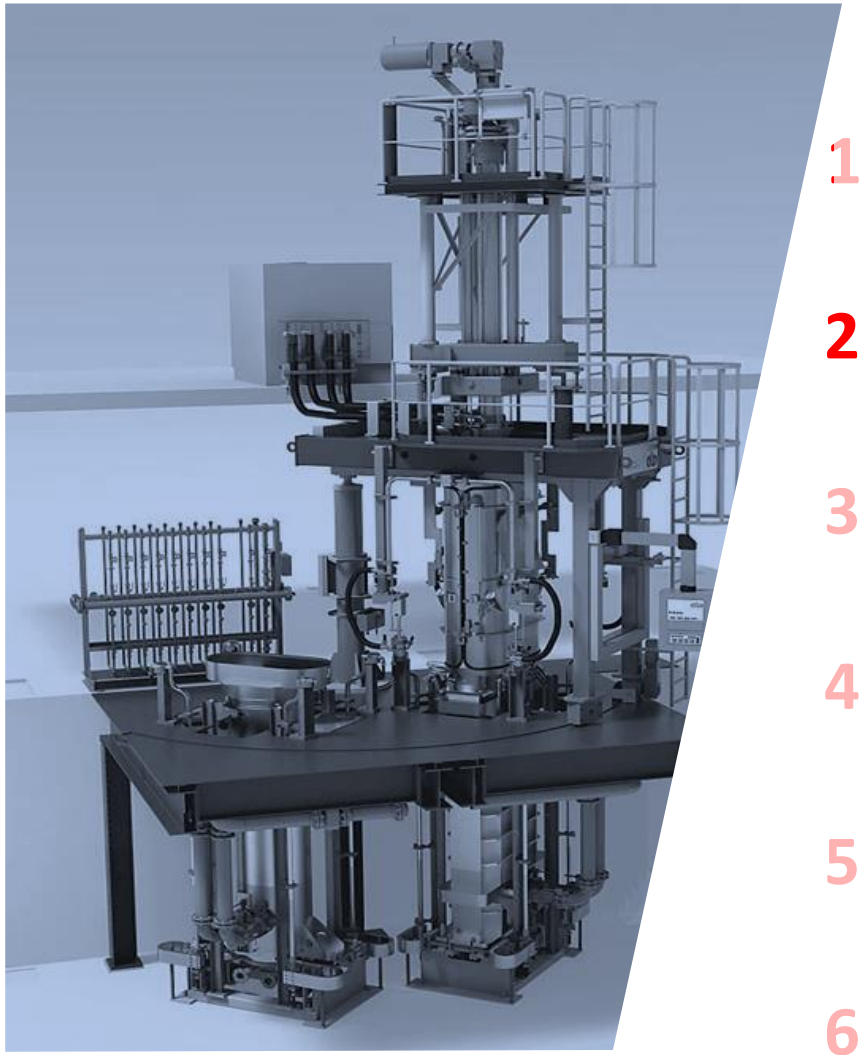
HISTORY OF ALD VACUUM TECHNOLOGIES GMBH FROM 1843 - 2023



First **ESR** Furnace was commissioned in 1967 !

- Individual solutions for vacuum metallurgy and vacuum heat treatment sector
- Worldwide care and maintenance service of ALD high-quality equipment for their entire lifecycle.
- ~ 860 employees
- Engineering facilities in Germany, France, U.S., India and China
- Four heat treatment service centers (HTS) in Germany, the U.S., Mexico and China
- Owns 63 patent families

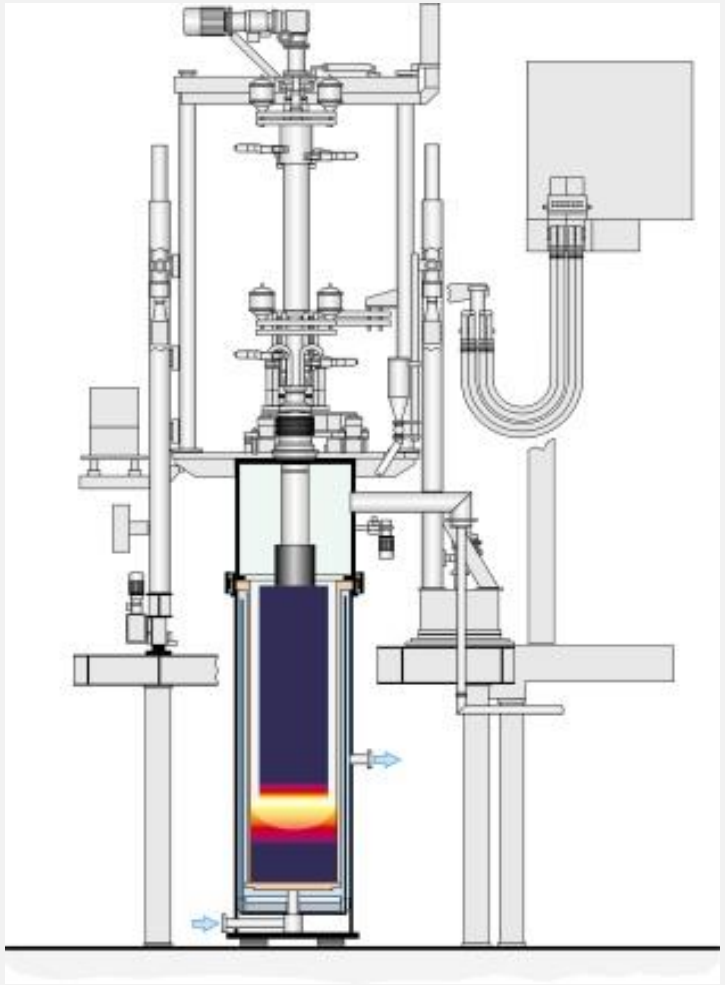
Outline of topics



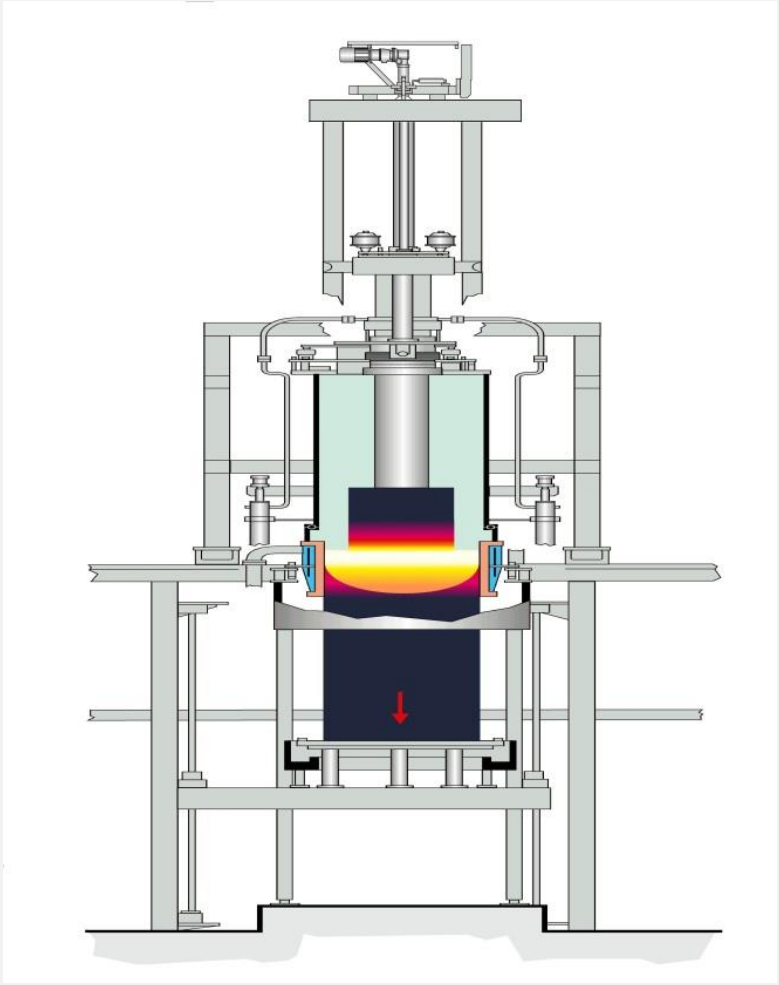
ESR IN STATIONARY MOLDS - NI- BASE ALLOYS

STATE OF THE ART STATIONARY PROCESS DESIGN - ATTRIBUTES

Static Mold System
with single electrode
in stationary mold



Retractable Mold Design
with electrode exchange (semi enclosure system) and ingot withdrawal



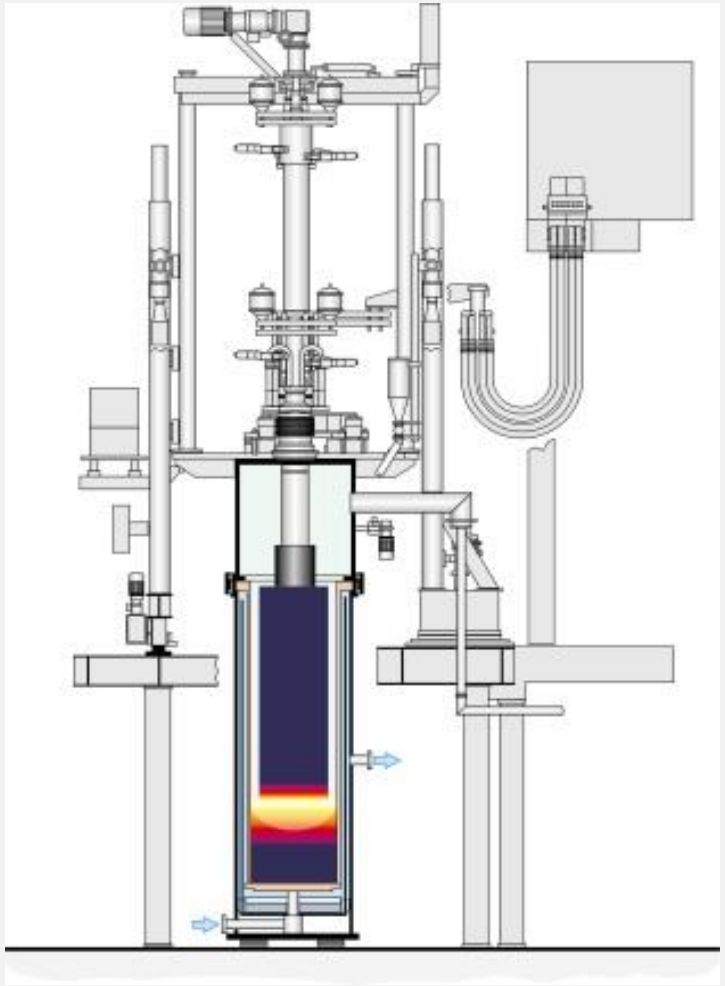
ESR IN STATIONARY MOLDS - NI- BASE ALLOYS

STATE OF THE ART STATIONARY PROCESS DESIGN - ATTRIBUTES

Static Mold System
with single electrode
in stationary mold

Nowadays the design will be extended to larger Diameters (1400 mm) and ingot lengths and weights (40 t)

* Withdrawal mold design up to 300t

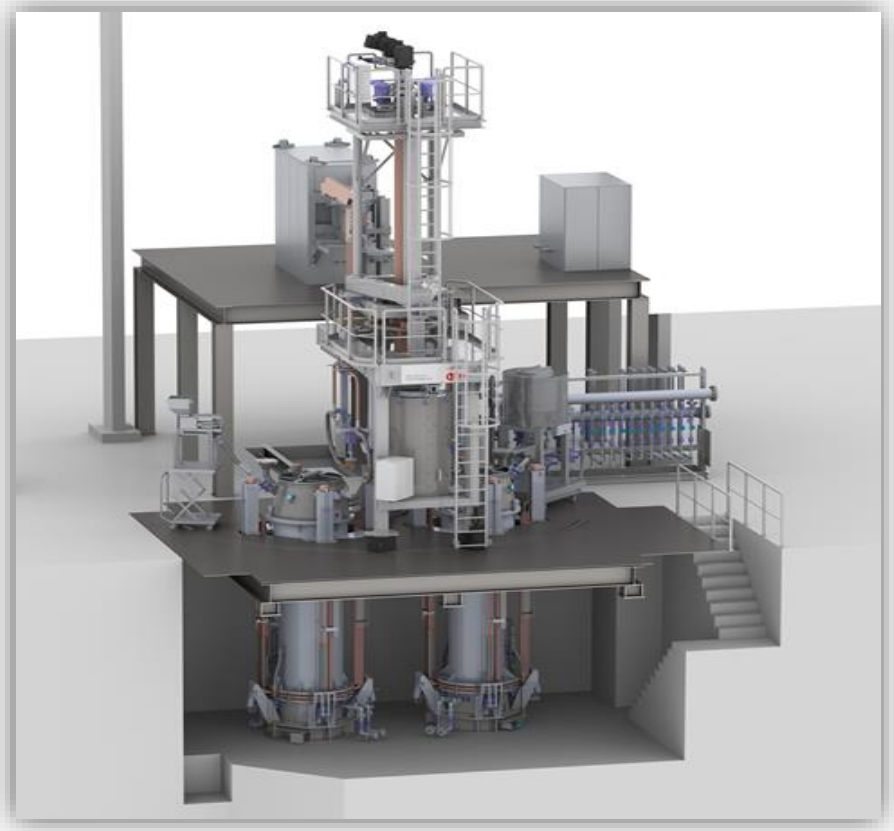


Advantages:

+ simple automated operations
+ greatest flexibility in slag systems (chemistries and application) reactions on ingot chemistry
+ premium ingot quality due to melting under inert conditions without melt interruption
+ flexibility in electrode diameter and melt rate
+ low production cost but size limited
+ good power efficiency

FURNACE DESIGN – STATIONARY FURNACES

Half shell design



Chamber design

FURNACE DESIGN – STATIONARY FURNACES

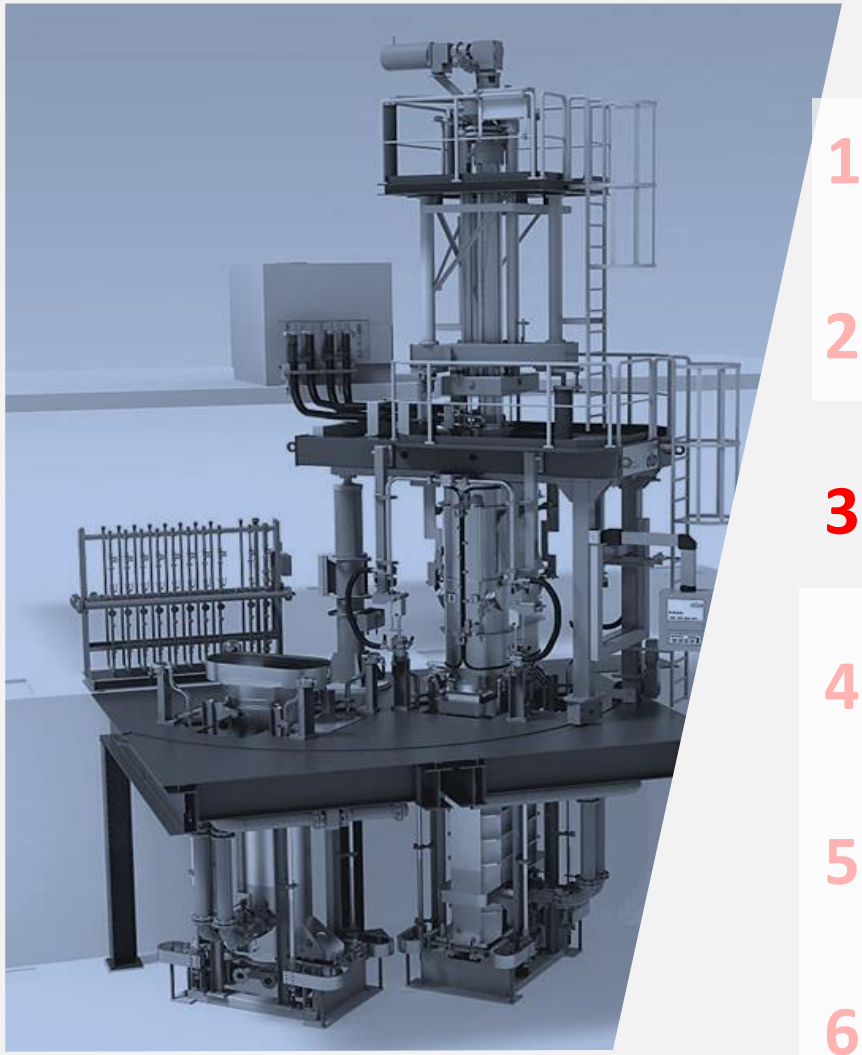
Half shell design

- Less building height
- Hot topping in open or closed mode
- Less expensive equipment
- Fixed current loop and short bus bars
- Easier cleaning of fume exhaust hood

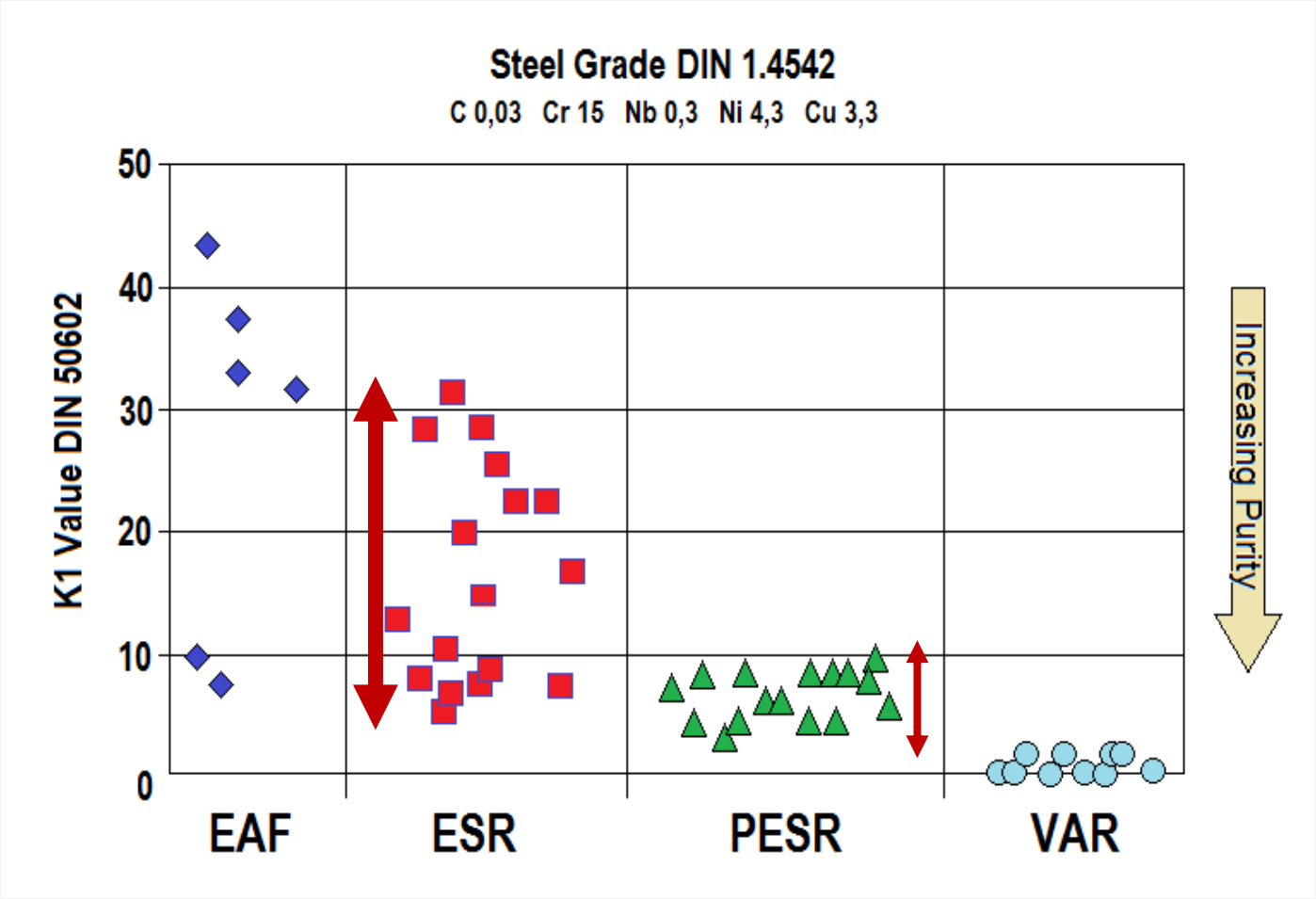
Chamber design

- Runs under pressure, avoiding hydrogen pick-up
- Closed-type melt chamber for enhanced security
- Equipped with vacuum pumps and dust filters
- Dynamic vacuum-tight seals for better performance

Outline of topics



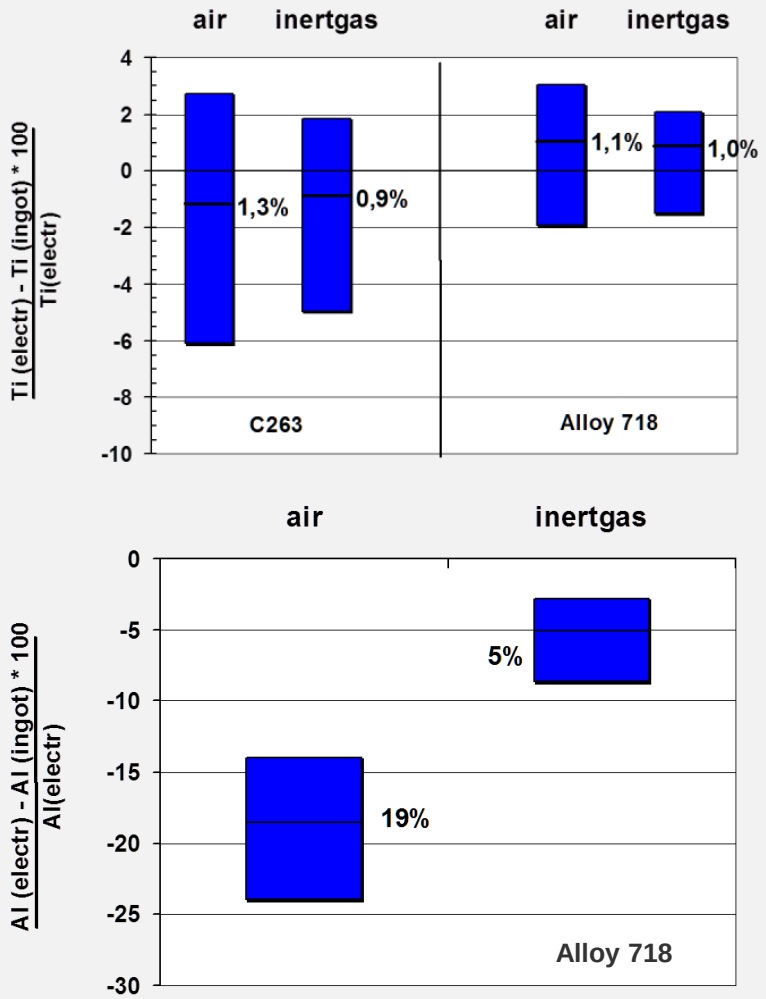
ESR IN STATIONARY MOLDS - DESIGN AND QUALITY FEATURES
STANDARD PROCESS ROUTES IN REGARD TO QUALITY



+ Multiple steps in process route results in best cleanliness values
+ Smaller scatter with Inert-gas (Protective) ESR

Ref.: Böhler Edelstahl GmbH & Co KG
5th International Conference on Tooling, Leoben Austria, 1999

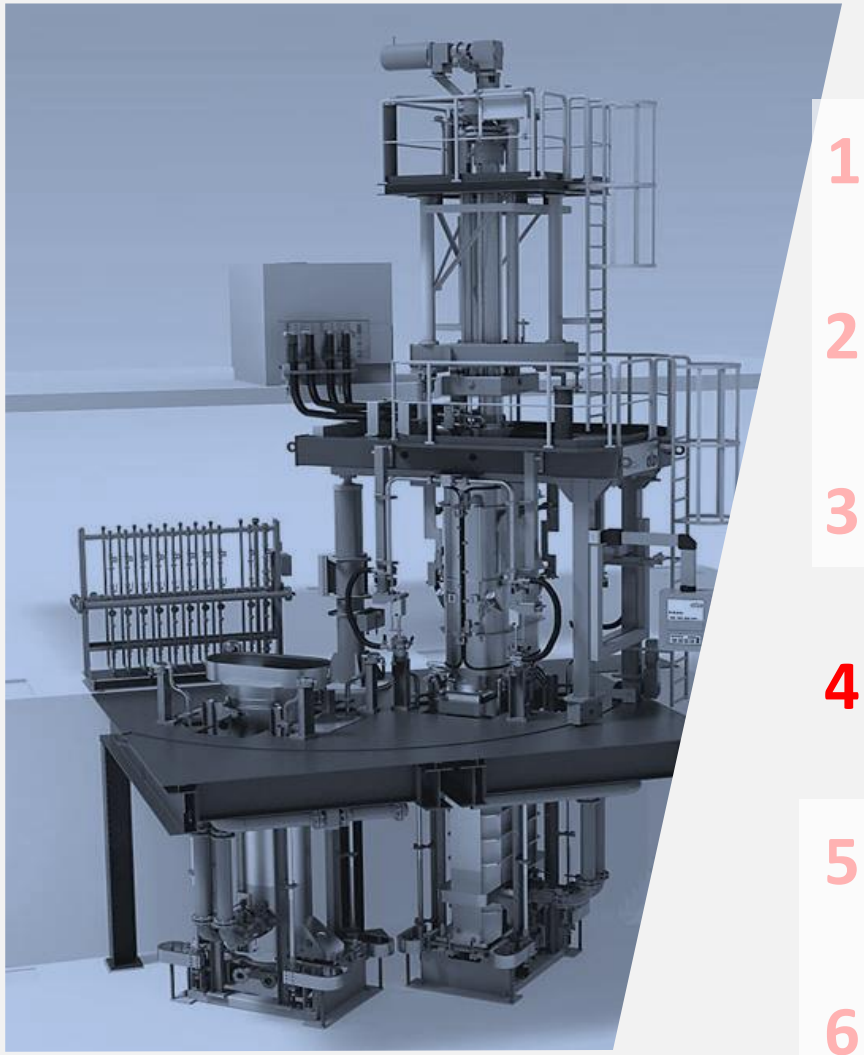
ESR IN STATIONARY MOLDS - DESIGN AND QUALITY FEATURES
WHY UTILIZE A CLOSED SYSTEM



+ No Hydrogen pick up
+ Homogeneous slag basicity
+ Less burn-off of expensive alloy-components
+ Smaller scatter in alloy composition
+ Environmental safe operation
+ Minimum gas feeding and cleaning capacity required

Ref.: Thyssen Krupp VDM GmbH, Unna, Germany
LMPC 2001, Santa Fe, New Mexico, USA

Outline of topics



ESR IN STATIONARY MOLDS - DESIGN AND QUALITY FEATURES
STANDARD PROCESS ROUTES FOR NICKEL- BASE ALLOYS

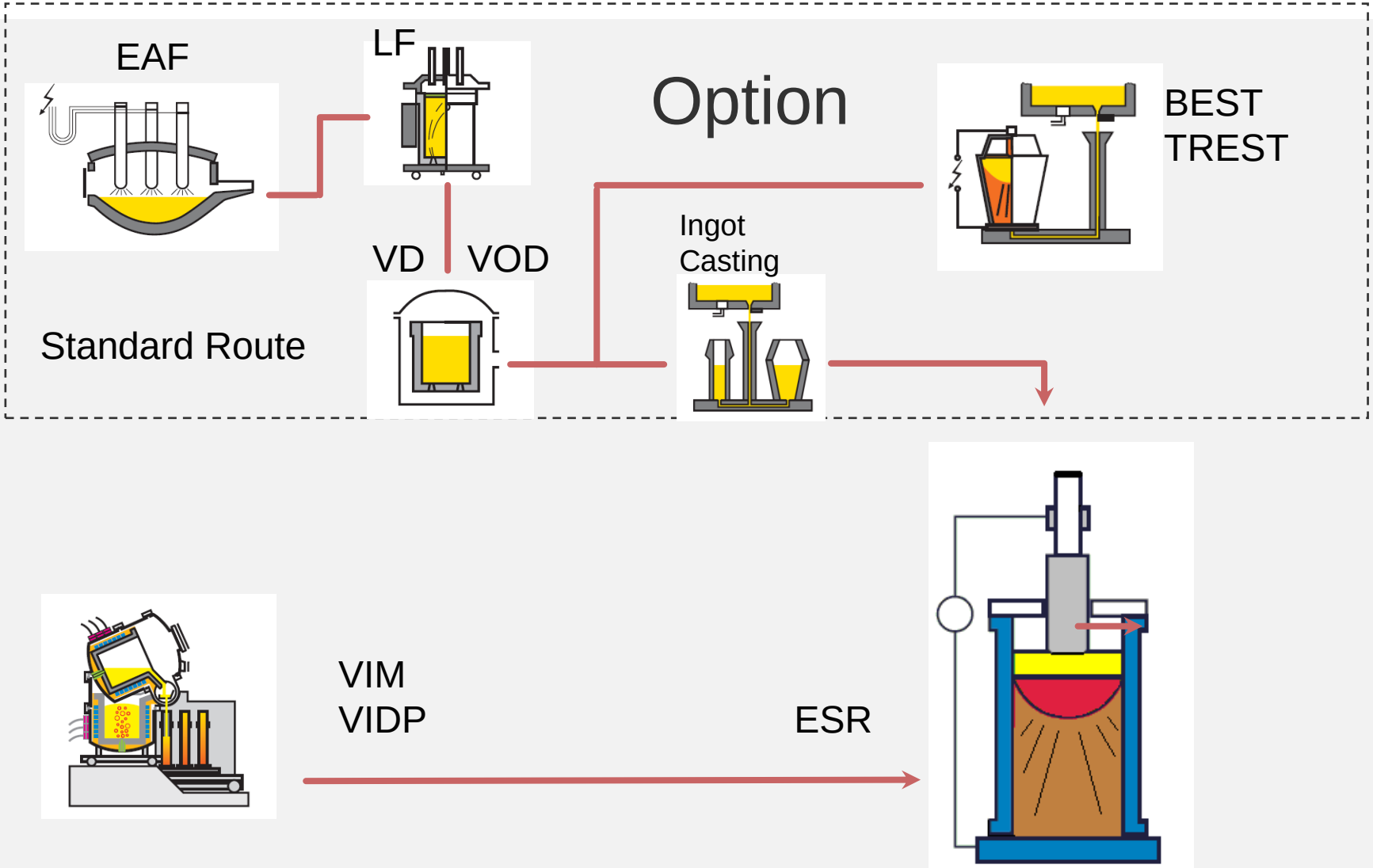
Inconel (Ni-Cr)

Nimonic (Ni-Cr-Co)

Incoloy

Monel (Ni-Cu)

Fe-Ni Legierungen



ESR IN STATIONARY MOLDS - DESIGN AND QUALITY FEATURES (NI- BASE ALLOYS)

ROUTE SELECTION BY WEIGHT (SIZE) AND QUALITY REQUIREMENT

Melting

Secondary Metallurgy: Melting capacity 25t up to 300t
(EAF, Ladle, VD, Converter Technology)

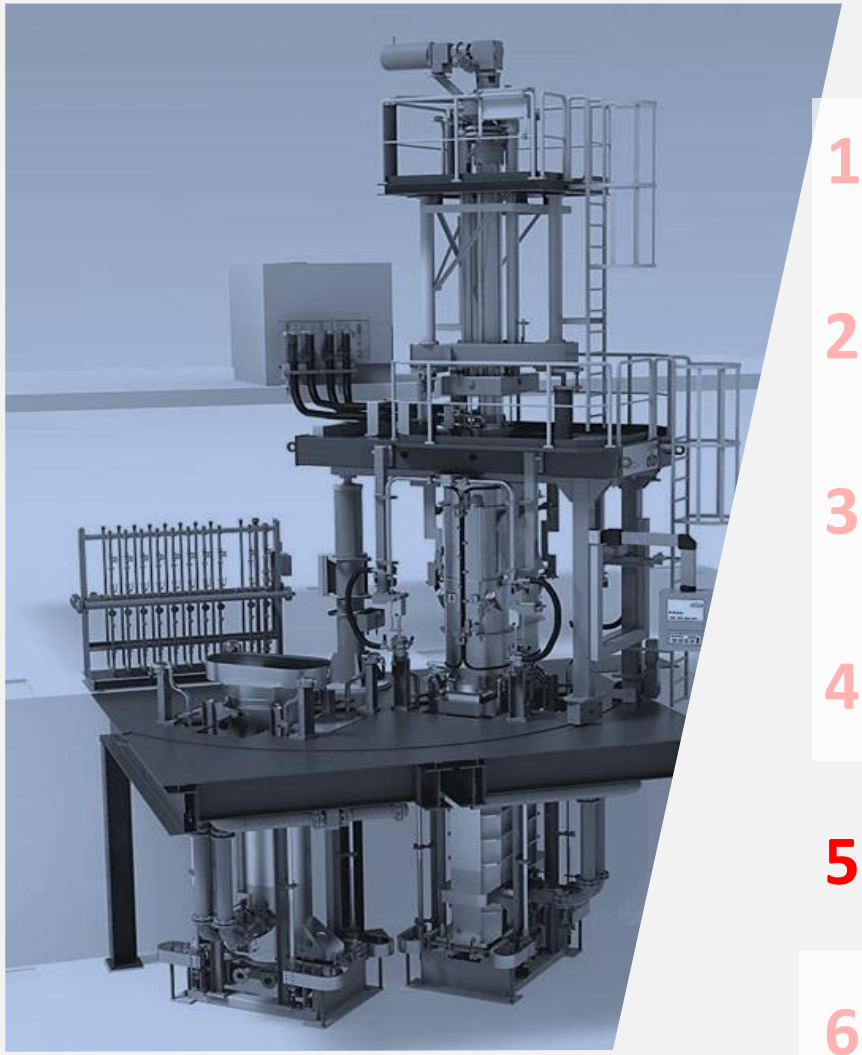
Vacuum Induction Melting: up to 30t

Re-melting / Re-fining (Stationary Design)

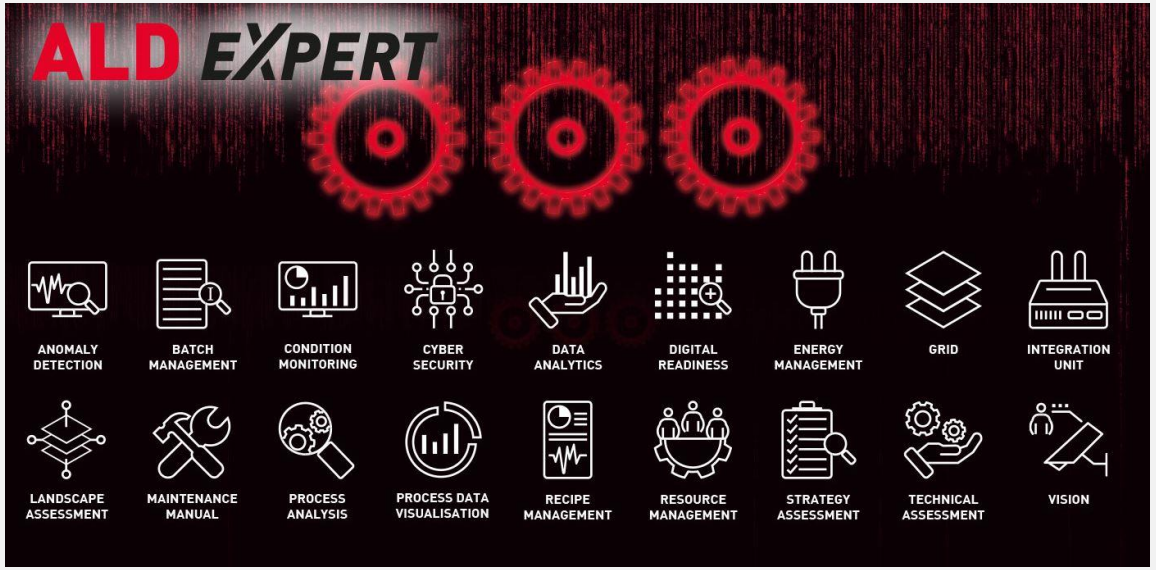
ESR: Diameter 1400mm Weight 40t *

* Withdrawal mold design up to 300t

Outline of topics



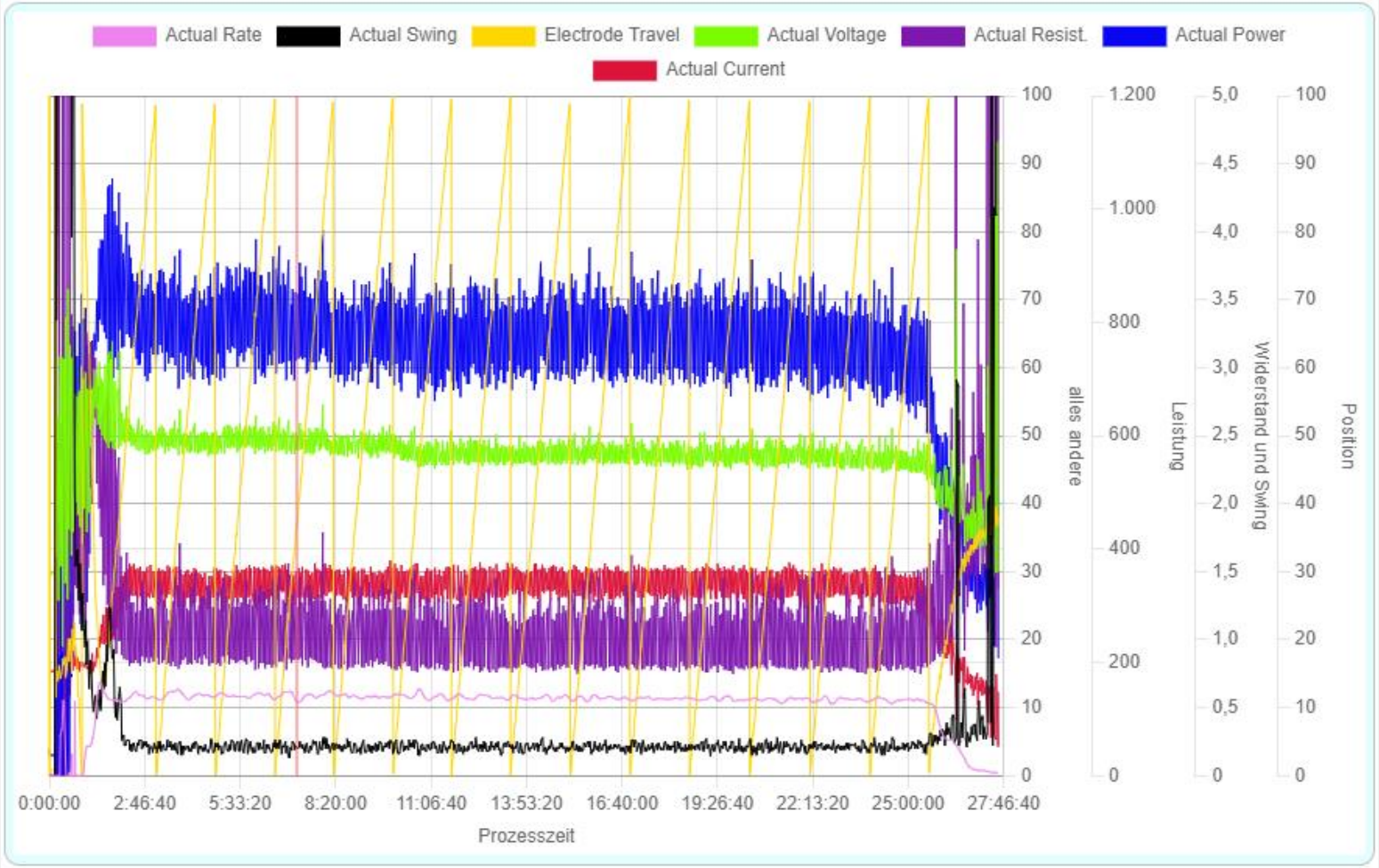
ALD EXPERT INDUSTRY 4.0 AND DATA MANAGEMENT



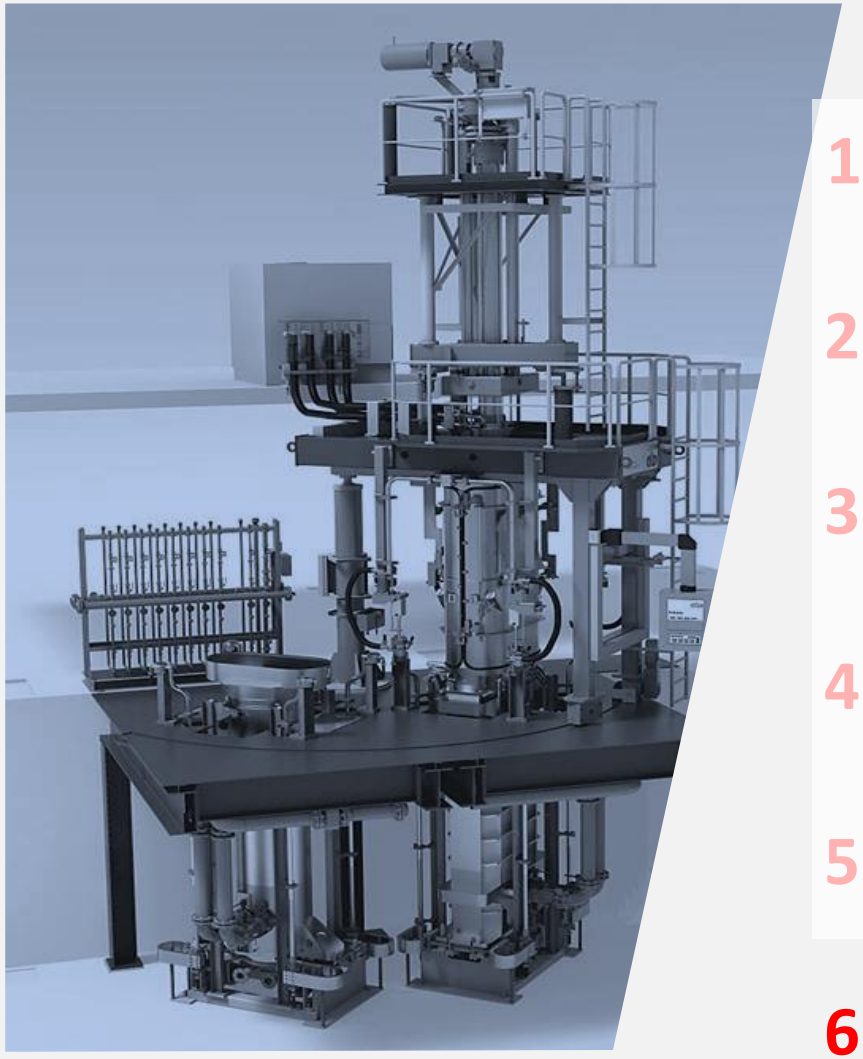
- Tailor-made special industrial digitalisation and automation solutions
- Combination of know-how on the topic of digital transformation in the industrial environment with advanced knowledge of process and plant technology in the fields of metallurgy and heat treatment

- End-device-independent web-based solutions:
  Access to the solution from anywhere through a secure VPN tunnel
- Modular and open solution architecture:
  Expandability of the functional scope of the individual software modules as well as integration of higher-level systems
  (ERP, MES etc.)
- Open solution design:
  The solutions can run on hardware (industrial PC or similar) as well as virtualised on a server of the customer

I 4.0 EXAMPLES



Outline of topics



ESR AND VAR – COMPARISON OF THE ATTRIBUTES
LATEST TRIPLE MELT REFERENCE

VIDP 4000

ESR 1400 P40

VAR L1300 P36

THANK YOU