

Premium Quality through Remelting

VDM Metals forms the High Performance Alloys (HPA) division of Acerinox. The production of HPAs is partly different from the production of standard stainless steels – sometimes right from the beginning.

VDM Metals operates melting plants in Unna, Germany, and Florham Park, New Jersey, to produce its nickel-based materials and special stainless steels. In addition to the conventional technology of open melting via Induction Furnace or Electronic Arc Furnace – which are commonly used for stainless steel production –, VDM Metals also uses vacuum melting and remelting facilities. The melting process of alloys that are prone to a critical oxygen or nitrogen pickup or that demand high cleanliness starts in a vacuum induction (VIM) furnace. The homogeneity and purity of the materials can furthermore be enhanced by electroslag remelting (ESR) or vacuum arc remelting (VAR).

„Depending on the final application, VIM produced ingots are often used as electrodes in ESR and VAR processes. In cases of special requirements, we even use the triple-melt procedure

to ensure that our materials meet extremely stringent quality specifications of our customers“, explains Matthias Steinhoff, Head of VIM/ESR/VAR Operations in Unna. Superalloys like VDM® Alloy 718 are typically produced by VIM in combination with subsequent remelting. With regard to the type and number of remelting processes, a distinction is essentially made between the double-melt and the triple-melt route. In the

former, the ingots produced in the VIM furnace are remelted as electrodes either in the ESR process for standard quality or in the VAR process for premium quality.

Both processes – ESR and VAR – use the ingot from primary melting as a self consuming electrode and form a new ingot in a water cooled crucible with superior ingot quality with regard to segregation level and cleanliness. The rapid

solidification in the water cooled crucible guarantees a good and homogeneous solidification structure. But in detail there are differences between both processes.

ESR is one of the most important technologies in the production of superalloys of highest demand for various applications. Starting from the very beginning when ESR was used only as a desulphurization step in the

The plant in Unna is equipped with various ESR (blue) and VAR (red) units



late sixties, the ESR process gained popularity for achieving superior ingot quality in large-scale production.

In the ESR process, that commonly runs on alternate current, a molten slag works as a resistance heating between the electrode and the rising new ingot. The contact to the hot slag bath with temperatures around 1800°C slowly melts the electrode and every metal drop falls through the slag where impurities from the primary melting are absorbed.

In some cases the strict quality requirements of end users call for a metallurgical refining process that enhances the product quality to the highest level. The VAR process has been developed in the 1950's with the aim of satisfying these increased demands on certain material properties of the final product. In the VAR process, an electric arc arises between the self-consuming electrode and the rising new ingot. The material purification results from degassing in vacuum and flotation on top of the melt pool.



Remelted ESR ingot produced in Unna

In some cases, the triple melt route is also used, in which a VIM ingot is remelted in the ESR process first and the ESR ingot produced is remelted again in the VAR process. “Triple-melt is the ultimate challenge”, says Mr. Steinhoff. It can maximize the degree of purity and can minimize the probability of critical macro defects – which is a must in some mission-critical applications, for example in the aerospace sector.

Matthias Steinhoff



VDM Metals