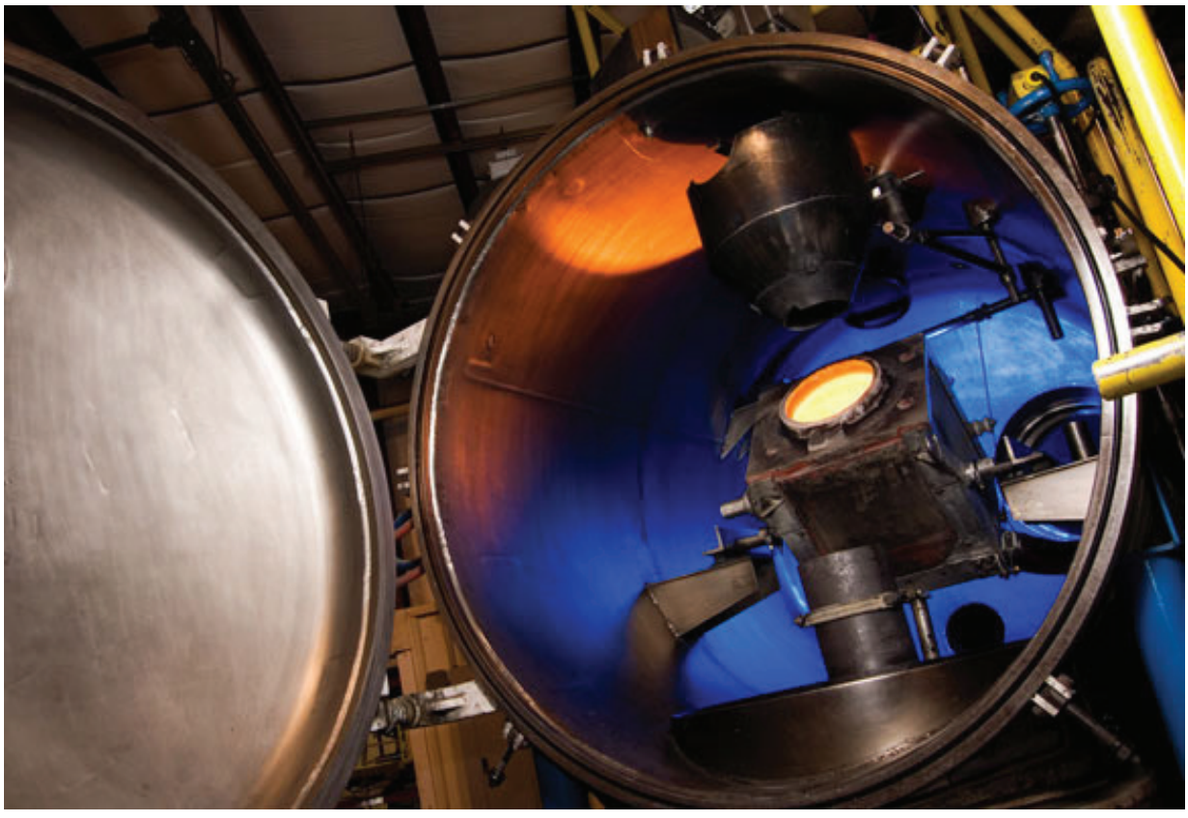
SOLBERG®
Filtration - Separation

Training Paper
Vacuum Induction Melting (VIM)



TR-VIM-BE1016

Training Paper
Vacuum Induction Melting (VIM)

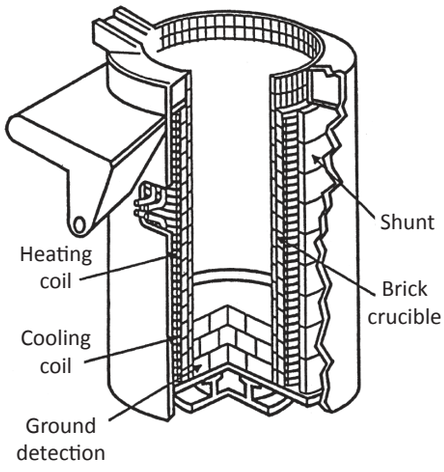
What is Vacuum Induction Melting

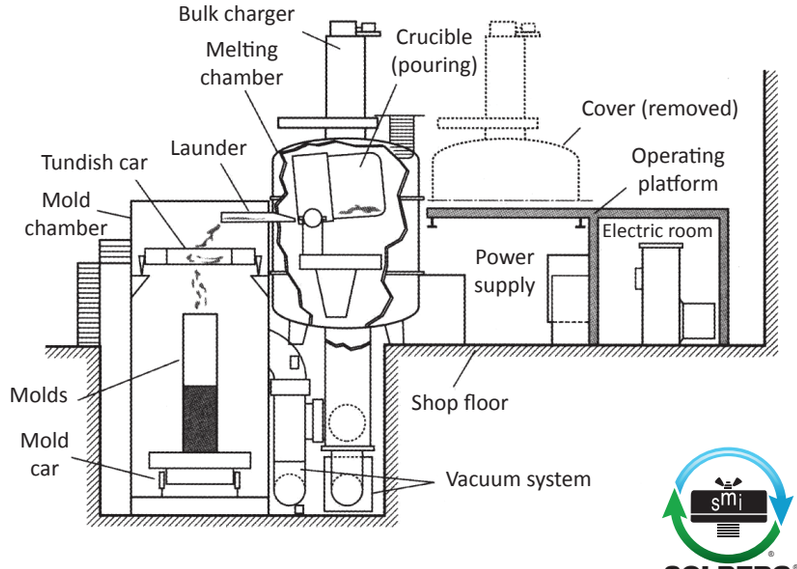
Melting under vacuum in an induction-heated crucible is a tried and tested process in the production of liquid metal. The process is relatively flexible, featuring the independent control of time, temperature, pressure, and mass transport through melt stirring. Vacuum induction melting can be used to advantage in many applications, particularly in the case of the complex alloys employed in aerospace engineering. The following advantages have a decisive influence on the rapid increase of metal production by VIM:

- Flexibility due to small batch sizes
- Fast change of program for different types of steels and alloys
- Easy operation
- Low losses of alloying elements by oxidation
- Achievement of very close compositional tolerances
- Precise temperature control
- Low level of environmental pollution from dust output
- Removal of undesired trace elements with high vapor pressures
- Removal of dissolved gases, for example, hydrogen and nitrogen

Process Description

A VIM furnace is simply a melting crucible inside a steel shell that is connected to a high speed vacuum system. The heart of the furnace is the crucible with heating and cooling coils and refractory lining. Heating is done by electric current that passes through a set of induction coils. The passage of current through the coils creates a magnetic field that induces a current in the charge inside the refractory. When the heating of the charge material is sufficient that the charge has become all molten, these magnetic fields cause stirring of the liquid charge. The optimal induction coil frequency for heating the charge varies with the charge shape, size, and melt status (liquid or solid). Older equipment used a single frequency, but newer power supplies are able to be operated at variable frequencies and are adjusted throughout the melt to obtain the most rapid heating/melting conditions.





Training Paper
Vacuum Induction Melting (VIM)

The furnace is kept at a high vacuum (.1 to 10-4 mbar). In some cases the air will be replaced by an inert gas, in most cases argon. VIM can be combined with pouring in vacuum conditions. The vacuum ensures lower oxide levels and thus a lower amount of porous inclusions which make the material more brittle. This process permits the refining of metals and alloys that contain elements having a strong affinity for certain gases such as oxygen. Chemical reaction, dissociation and flotation remove dissolved and chemically bonded impurities. Melt chemistry can be accurately adjusted thereby producing an end product that is clean and homogeneous.

Application Example

Russia.

Process parameters	
Process Type:	VIM Continuous Ingot Casting
Chamber Volumes:	45m³ Melt Chamber 26m³ Casting Chamber
Air Flow:	33.000 m³/hr total flow @ 0.001 mbar absolute (16.500 m³/hr flow @ 0.001 mbar absolute per filter unit)
Operating Pressure:	0.001 mbar absolute
Temperature:	135°C @ filter unit inlet
Filter Elements:	TF475E; PTFE with polyester backing; 99.5% particle
Filter Housing:	RX-TF475E(6)-DN400
Cleaning:	Pulse cleaned with 1.0 bar absolute Nitrogen
Units Installed:	2 units

SOLBERG®

SOLBERG®
Filtration & Separation

Training Paper

Vacuum Induction Melting (VIM)

Kapelanielaan 8, Temse Belgium B-9140
+32 3 774 52 11 Fax: +32 3 886 93 71
BEsales@solbergmfg.com

TR-VIM-BE1016