

Luciano Bosis

Bosis one barrels

ESR Process (ElectroSlag Remelting)

In the ESR process the ingot coming from the ingot mould melting process is used as a remelting electrode (consumable electrode).

The electrode melts thanks to molten slag that generates heat (Joule effect). The advantages of this system are:

- 1 More refined grain
- 2 Increased purity
- 3 Best way of eliminating sulphides, segregations and other defects

VAR (Vacuum Arc remelting)

In the ESR process the ingot coming from the ingot mould melting process is used as a remelting electrode (consumable electrode) in the following plant:

A different electric potential is applied between the electrode and the bottom of the mould in order to create an electric arc whose heat melts the metal drop by drop (like in the metal-arc welding). The atmosphere above the arc is extremely rarefied thanks to a powerful system of pumps that create vacuum. Vacuum throughout the process improves the metal as follows:

- 1 No segregation
- 2 More refined grains
- 3 Increased purity
- 4 Less gas content
- 5 Decomposition of sulphides and other impurities
- 6 Reduced risk of contamination

Brief summary:

| Conventional melting processes | | | Specialty remelting processes | |
|--------------------------------|--|------------------------------|--|--|
| PRIMARY METALLURGY | | | SECONDARY METALLURGY | |
| 1 | 2 | 3 | 4 | 5 |
| Cycle melting | Molten in electric furnace EAF | Molten in electric furnace | Molten in electric furnace Degassed | Molten in electric furnace Degassed |
| Continuous melting | | Degassed under gas or vacuum | ESR remelting | Remelting under vacuum VAR |

6) Forging

By **forging** we describe the industrial process by which metal pieces in different sections undergo a plastic transformation. They are generally brought to the red-hot status when the iron crystal changes from "alfa" into "gamma" and then are hit by many hammer drops. This process refines the metal crystalline grain (gamma) which breaks into many pieces because of the pressure applied at very high temperature. The grain edges start to transform into perlite (carbon is more soluble in a

“gamma” solid and during the transformation process it precipitates and aggregates in Fe_3C , forming different mixes of cementite and ferrite: perlite). The mechanical resistance of forgings over regular perlite increases for two reasons:

1The stress spreads on a wider surface when the grain is finer;

2The piece is less affected by the different hardness of the grains. Breaking starts where the bigger and more rigid grains are.