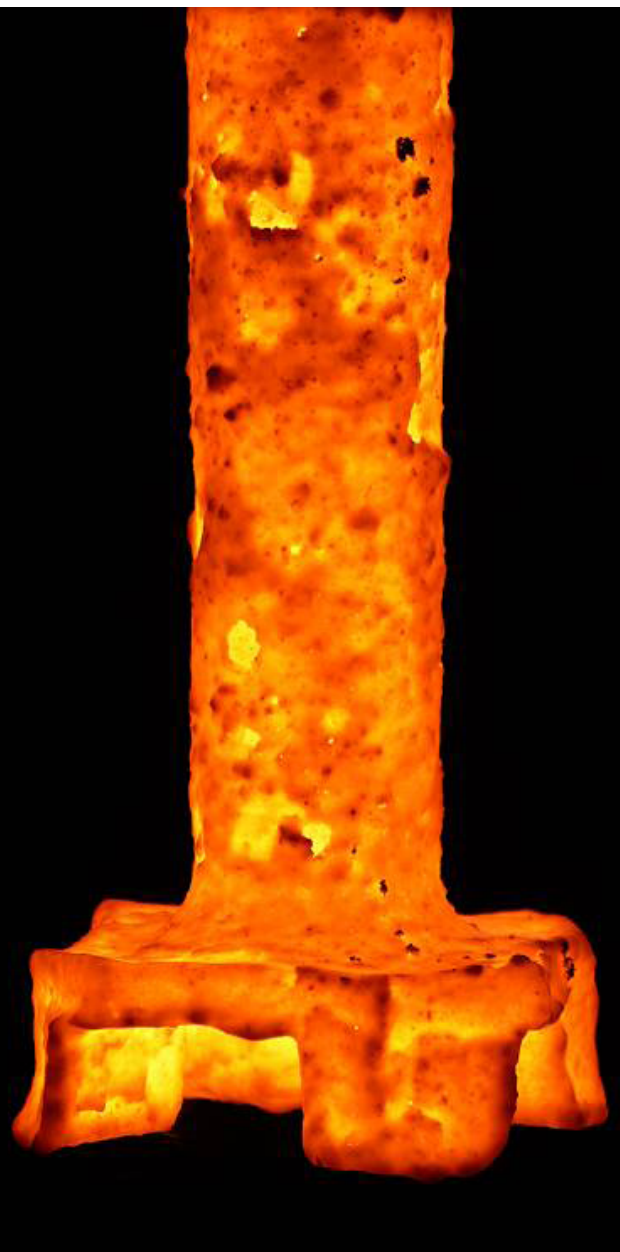


## ROTOCLEASE\*

Rotary treatment of molten metal at the pouring ladle

VESUVIUS



## ROTOCLENÉ process

for producing the highest quality, inclusion free steel for casting

There is continual pressure for castings to be lighter and stronger with better low temperature properties and higher fatigue resistance. This means that steel castings have to be free of damaging inclusions or shrinkage, and have a fine microstructure. Foseco's ROTOCLÉNE process helps with all of these.

### What is ROTOCLÉNE?

The process brings together Foseco products from across the foundry and steel making industry. The equipment used is a rotary machine, which is a modified version of the tried and tested equipment that Foseco has supplied for use in non-Ferrous applications for many years. The Rotor is made from Vesuvius's VISO\* material, and we can supply ladle linings allowing for treatment with our desulfurizing fluxes and cored wire.

WATCH THE ANIMATION ABOUT  
THE ROTOCLÉNE PROCESS





# ROTOCLENE process

for producing the highest quality, inclusion free steel for casting

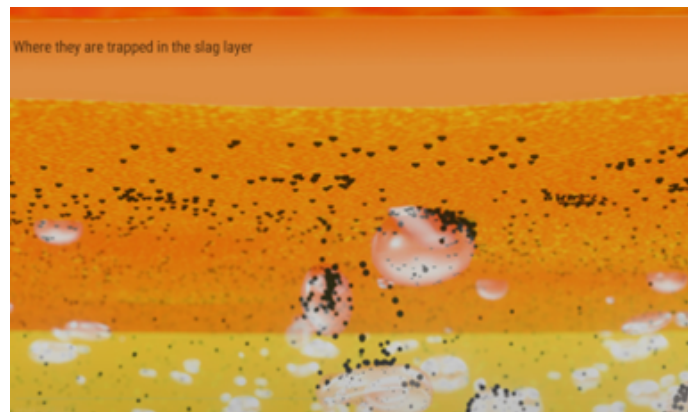
The ROTOCLENE process has been developed to treat molten metal effectively in the ladle. For reducing hydrogen and nitrogen pick up we would ideally deoxidise the melt with cored wire before or during the rotary treatment rather than into the stream during metal tapping from either arc or induction melting furnace. A hollow ceramic rotor stirs the molten metal as argon is purged through it gets dispersed to form curtains of very fine bubbles. (Fig 1).

These float up slowly in a helical trajectory that extends their passage through the metal rotating around the vertical axis of the ladle. Slag particles inclusions and oxide films adhere to surface of the argon micro bubbles and float up into the slag layer at the top. The small size of the argon bubbles gives them a long residence time in the melt and together with the extended floating trajectory means that very effective metal purification is achieved (Fig 2).

The rotation of the melt also effectively homogenizes metal temperature and eliminates critical cold spots at the bottom (Fig 3). Molten metal in the ladle keeps rotating through its moment of inertia even several minutes after the end of the rotary treatment. The metal temperature stays consistent at any ladle location without cold spots (Fig 4) and pouring temperature can be significantly reduced compared to conventional practice.



Very fine Ar bubbles helically dispersed



Effective bifilm and inclusions removal by Ar bubbles



Cold spots of metal after the tapping



Metal temperature homogenization by ROTOCLENE - Rotary Treatment Process

# Benefits & Applications

ROTOCLENE process allows an improvement in quality that more than pays for itself in the reduction of rework

Through use of ROTOCLENE and HOLLOTEX shroud we have found it is possible to reduce the pouring temperature by 30 degrees, and sometimes more. Our target is to get pouring temperature as low as possible.

This has beneficial effects for the shrinkage properties of the steel as it is cast. Lower temperature means less liquid shrinkage of course, but it also means less heat going into the sand mould. With less superheat of the sand, the casting cools faster, which means less time for dendrites to grow, and a finer cast structure.

All this means that the casting has better feeding properties, less macro shrinkage and importantly less tendency to microshrinkage. The castings that benefit from the process the most are those requiring the highest quality. ROTOCLENE increases the quality by reducing inclusion numbers and porosity, which can give improvements in Ultimate Tensile Strength, Elongation, low temperature impact and fatigue strength.

In trials it was found that the numbers of inclusions were significantly reduced. In this case the number of inclusions in a test bar produced alongside a casting was found to be almost halved when the steel was treated with the ROTOCLENE process versus purging plug.

For X-Ray inspection, the number of castings requiring re-work was reduced, and above the savings that are made on re-work, the cost of re-inspection is also avoided and castings can be shipped faster. All this means a significant saving in the cost of repairing and checking defective castings.

Overall the ROTOCLENE process allows an improvement in quality that more than pays for itself in the reduction of casting repairs.

## Usage and Limitations

Any type of steel, from carbon steel to super duplex, can be treated by this process. There is always benefit from inclusion removal and temperature homogenization, allowing significant pouring temperature reduction. The layer of liquid slag protects the melt from hydrogen and nitrogen pick up, making it suitable for treating nickel-based alloys as well.

The smallest size of treatment is around 4 tonnes, while the largest ladle that can be treated properly is up to 16 tonnes due to the size of the machine and the length of the rotor. The treatment takes ideally around three to five minutes depending on the ladle size.



# Application and services

## Service

Our engineers and product managers work in partnership with our customers to help them improve productivity, process control, casting quality and the working environment.

## Simulation

Mold filling and solidification simulation is an essential tool for the modern methods engineer. All our experts have access to the latest simulation technology through our alliance with MAGMA® GmbH, the world leader in solidification and Flow Simulation technology for the foundry industry.

## Key Benefits

- + Metal temperature homogenization
- + Inclusions and Bifilms removal
- + Desulfurization by synthetic slag
- + Alumina inclusions modification by pure Ca (video of treatment)
- + Pouring temperature reduction
- + Shrinkage and porosity reduction
- + Casting surface improvement
- + Mechanical properties increase
- + Castings supplied faster due to less rework



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