# ZIRCON-FREE REFRACTORY COATINGS FOR IRON AND STEEL CASTING

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Zircon-based refractory coatings are widely used in foundries around the world. However, the use of zircon is problematic due to it being a naturally occurring radioactive material (NORM). Prices for zircon have also risen steeply in recent years, and remain volatile. Foundries are therefore looking for refractory coatings that reduce or eliminate the use of zircon. In response to this market demand, Foseco has developed the TENO* Tec ZA zircon-free family of coatings, which have now been successfully applied at multiple foundries in Europe.

## INTRODUCTION

The use of zircon-based coatings is widespread in iron and steel foundries, due to their high refractoriness. Zircon has a melting point of 2,100-2,300°C, and maintains physical and chemical stability, even at elevated temperatures. This enables zircon-based refractories to withstand the high thermal stresses involved in steel and iron casting applications, and so reduce or eliminate metal burn-on and penetration defects in the castings. However, zircon is a naturally occurring radioactive material (NORM). This has raised concerns within the industry about its use, with some companies placing limitations on the use of radioactive products. Prices for zircon have also risen significantly in recent years – due to increased demand from other industries and transportation costs – and remain volatile.

Seeing the need for novel refractory coatings that reduce or eliminate the use of zircon, Foseco developed a range of solvent-based, zircon-free coatings: TENO Tec ZA. This article discusses the successful use of TENO Tec ZA 7000 K at a foundry in Spain.

## CASE STUDY

Piezas y Rodajes S.A. (PYRSA) is the largest low-medium alloy steel foundry in Spain, producing more than 18,000 tonnes of finished castings per year for the mining, construction, high-speed rail, and agricultural sectors. Of these, large-scale castings for the mining industry are PYRSA's major activity – a sector that is characterised by growing technical demands. PYRSA integrates four processes at its Monreal del Campo facility (Figure 1):

- Steel casting (three moulding lines)
- Mass heat treatment
- Surface heat treatment
- High-performance machining

Figure 1. PYRSA Monreal del Campo facility, Teruel, Spain.

As one of its business goals, PYRSA aims to use environmentally-friendly products and materials at its facility. Faced with a new European resolution advising against the use of zircon-based refractory coatings, the company was seeking a new low-zircon or zircon-free alternative that could still deliver the same quality of casting at the same cost of production.

Figure 2. PYRSA manufactures high-quality steel castings for the mining, construction, high-speed rail, and agricultural sectors.

## NEW REFRACTORY COATINGS: TENO TEC ZA

Although zircon naturally emits radiation, it is not considered dangerous. However, it will be deTected and measured by a Geiger-Counter. Many foundries use these instruments to prevent entry of radioactive materials, often contaminated scrap metal, since this has been problematic in the past. When radioactivity is detected, it will result in alert in the foundry, regardless of the source. Companies are therefore interested in products that eliminate radioactivity from their production plants.

In collaboration with PYRSA, Foseco developed a new family of refractory coatings to minimise the use of zircon in the formulation. TENO Tec ZA coatings maintain the technical properties of zircon-based products, but by significantly lowering the use of zircon, they reduce exposure to radiation. In some cases, zircon is eliminated altogether. The new coatings do not therefore trigger radiation warnings in the foundry. TENO Tec ZA coatings also do not suffer from the same variability in production costs as zircon-based products. They therefore offer price stability that is competitive with (and at times of high zircon prices, lower than) zircon-based products. TENO Tec ZA coatings provide a very cost effective solution for eliminating zircon-based products and can reduce overall manufacturing costs, whilst delivering excellent casting performance.

## TESTING TENO TEC ZA 7000 K AT PYRSA

PYRSA carried out a range of tests using the TENO Tec ZA 7000 K coating with very good results. In both different applications (brush, spray gun, flow coating and dipping) and in casting dimensions, the results were similar to previous zircon-based coatings. Importantly, there was no radiation detected in the mould/core shop and storage area when using the TENO Tec ZA 7000 K, meeting expectations of the Foseco R&D team.

PYRSA is just one of the foundries currently working with the new zircon-free coating formulation. The need for change has been felt by many large iron and steel foundries, and there are many now using TENO Tec ZA coatings with similar good results. The specific characteristics of the TENO Tec ZA can also be adapted to the needs of the foundry and geometry of the moulds/cores, e.g., to provide greater penetration, longer draining time, and elimination of drips. Following on from the success of these solvent-based coatings, a new range of SEMCO Tec ZA water-based coatings are now available.


Figure 3. TENO Tec ZA 7000 K zircon-free coating used at PYRSA.

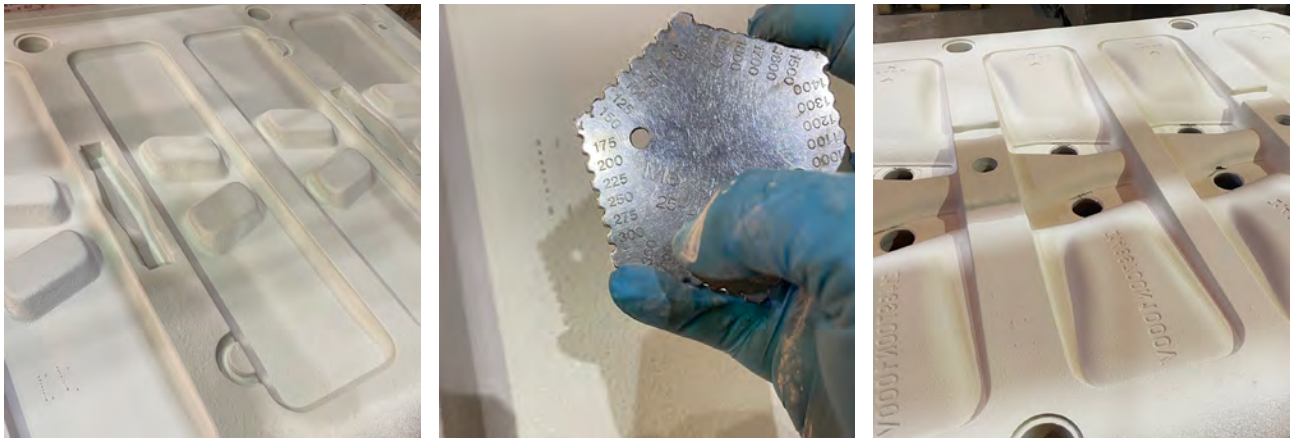

Figure 4. Homogeneous and smooth coating film. Spray gun, dipping and flow coating application.

Figure 5. Excellent results in massive castings. Free of burn-on and with good surface quality

## SUMMARY

Foseco has developed a new family of refractory coatings (TENO Tec ZA) to replace zircon-based coatings. The new refractory coatings demonstrate the following characteristics:

- Reduce or eliminate natural radiation.
- High refractory efficiency. Good surface quality of cast parts.
- Easy application in a variety of methods (brush, spray gun, dipping, or flow coating). .
- Very uniform coated surfaces without runs or drips.
- Stable and competitive price.

## ABOUT THE AUTHOR

Enrique has been with Foseco for 35 years and is currently Technical Director Iberia. In this role he is responsible for the development and application of our products in Spain and Portugal. He is also responsible for the supervision and monitoring of the Spanish manufacturing plants. It's a job where no two days are the same and it's never boring. In his free time, Enrique is passionate about sport, especially surfing. He also enjoys discovering new cultures through travel and reading.

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