System to significantly increase the effective yield of Calcium (and other alloying elements) in the treatment of specialty steels, while reducing impurities in the melt

Results in Brief

Calcium wire ladle treatment to improve steel cleanliness

The presence of inclusions results in a major difference between desirable and attainable level of cleanliness in many grades of commercial steel. EU-funded researchers have made the calcium treatment more efficient and cost effective to guarantee a higher standard of steel purity.

Increasing demand for high-quality steel products motivates continuous improvement of steel production practices. There is particular interest in the control of non-metallic inclusions due to their harmful effect on subsequent stages and their influence on the properties of the final product.

Through control of the amount, size and chemical composition of inclusions, it is possible to obtain a final product of high quality. The addition of calcium to molten steel
changes the composition of inclusions. Calcium is ideal, but current methods of adding it to the melt result in evaporation and inefficient reactions, representing high costs.

The EU-funded project **HOT-WIRE** (System to significantly increase the effective yield of calcium (and other alloying elements) in the treatment of specialty steels, while reducing impurities in the melt) devised a way of slowing calcium melting, thereby lessening evaporation, during the injection process.

The boiling point of calcium is about 1500 °C, much lower than the temperature of molten steel (about 1600 °C); so it evaporates if added loose. The new method involves a calcium wire clad in steel, which can be fed into the melt.

Extensive testing determined how much the calcium evaporation time can be extended. In addition, the researchers explored techniques for retarding melting of the calcium wire. Lastly, the team identified optimum methods of injecting the wire into liquid steel.

As a result, best practices have been defined. Project deliverables include documentation of the optimum combinations of wire-coating materials and methods for applying the system industrially. The project team also developed detailed designs for injection mechanisms.

The legacy of the HOT-WIRE project is an efficient and cost-effective method for reducing loss of calcium during the steelmaking process. Less calcium means a more profitable process and enhanced competitiveness for the European industry in the world steel market.

**Keywords**

Steel, calcium treatment, steel production, non-metallic inclusions, HOT-WIRE
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**Last update:** 23 May 2016
**Record number:** 151376