Specific challenges related to CO2 reduction in the foundry industry

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Abstract

Saint-Gobain PAM, created in 1856 in Pont-à-Mousson, is a world leader in the design and fabrication of ductile iron pipe systems for water. In order to produce the necessary iron, a variety of melting technologies are used, including a blast furnace (80% of production) and multiple cupolas. The metal is then transformed into pipes by centrifugal casting or into various other products via classic foundry techniques. With the ambition to reduce our environmental footprint, a program was launched in 2020 to progressively replace our carbon-intensive melters with electric furnaces.

There is a strong link between melting processes, raw materials and final product quality. Ductile iron obains its mechanical qualities through the presence of spherical graphite and a strict control of metallurgical structure. These two conditions depend on various parameters, in particular metal chemistry, the presence of impurities, solidification and heat treatment.

Transitioning from a blast furnace, fed with iron ore and coke, to primarily scrap-based electric melting allows significant CO2 reduction but also presents various challenges. Concerning the latter, the future availability of scrap is an important concern. Also, the process has to be designed to melt steel scrap – low C content and elements such as Mn, Cr, Cu – and obtain iron saturated in C and with a high level of Si. This leads to a number of practical and technical issues. Recarburizing the melt to raise C levels can be difficult with low yields. Some elements that are considered useful for alloying in the steel industry present significant problems at low levels for ductile iron.

The technical and industrial stakes related to these challenges, along with the ongoing work to address them, will be presented.