GJUTERI FÖRENINGEN
Swedish Foundry Association

TASTE OF SAND

Thermal Analysis and Gas Evolution in Moulding Materials

SUMMARY

The division of cast component manufacturing in sand moulds showed significant and continuous development in production volume during the last years in Sweden. The expectations from the customers towards ferrous and nonferrous castings are increasing on monthly basis, also from a quality point of view. Moreover, even though casting manufacturing processes are well-organized in most foundries, technological problems still appear. These trends are forcing the foundries to come up with fitting strategies to solve their daily production challenges, while their suppliers are expected to keep up the continuous development of their existing foundry products and to find new solutions. Thus, casting research is forced to reach a higher scientific level along with a stronger collaboration between industry and academia to generate state-of-the-art methods and understandings together to predict and avoid the formation of casting defects.

Thermal Analysis
Gas evolution

Fig. 1 - Measurement system

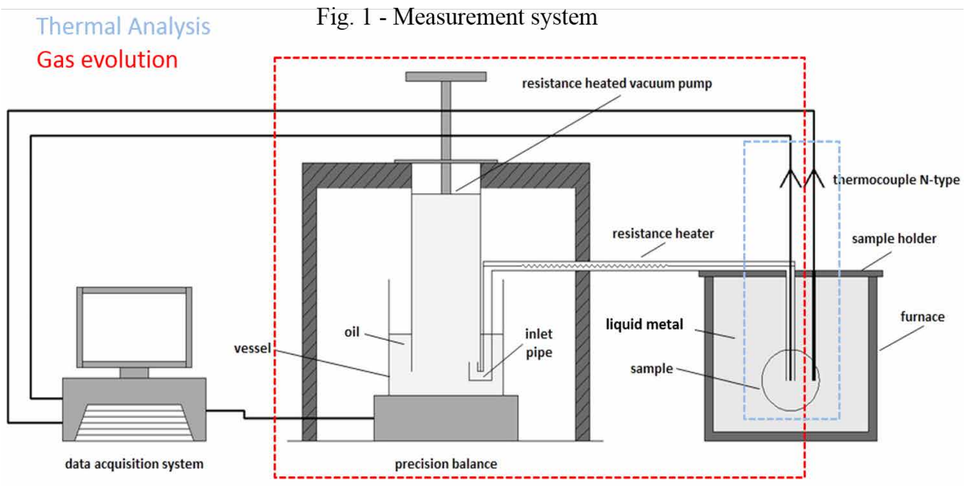


Fig. 2 - Cooling capacity (heat absorption) and gas evolution of a cold-box core

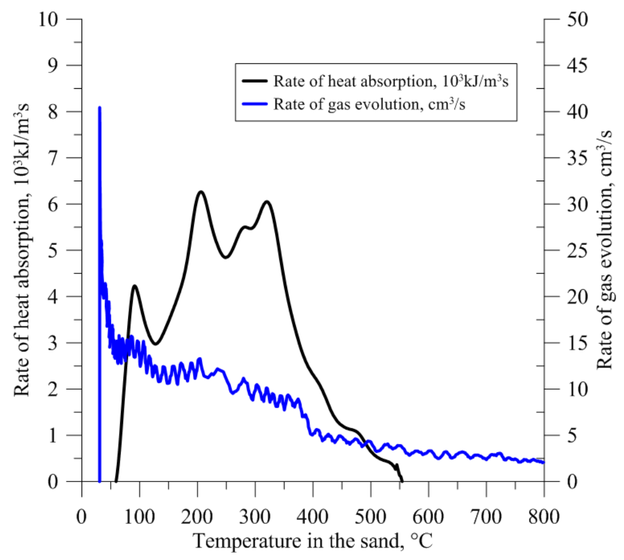
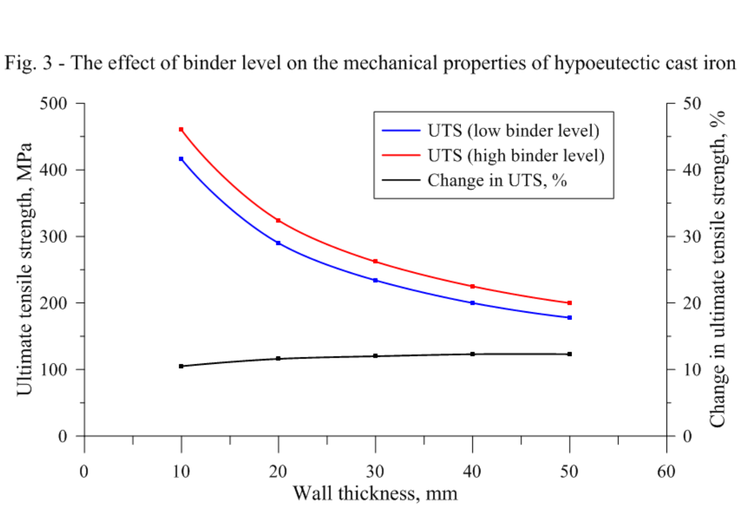


Fig. 3 - The effect of binder level on the mechanical properties of hypoeutectic cast iron



GOAL AND INTRODUCTION

The project “Taste of Sand” was a two-year long research activity which was performed by the Foundry Technology Research Group at Jönköping University, Volvo GTO and Scania CV AB, financed by KK-Stiftelsen. The goal was to develop a new type of measurement/scientific concept which is suitable to bring new light on the metal-mould interface phenomena and to obtain novel knowledge about the high temperature behavior of moulding materials. As the main outcome of the project, the measurement concept reached prototype status and the first results were implemented into casting process simulation.

RESULTS

The foundation of the concept is the simultaneous thermal analysis and gas evolution measurements in almost every type of moulding materials (Fig 1). The measurement layout recreates the metal-mould interface in real foundry conditions during the tests by using actual melts and sand sample sizes from production. The cooling capacity of the moulding materials (influencing the temperature gradient and the solidification) and the kinetics of gas evolution (influencing the formation of gas related defects) were the two main factors evaluated (Fig 2). Simulation prepared using initial properties originated from the project results shows the impact of the binder content on the final mechanical properties of the castings (Fig 3).

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INDUSTRIAL IMPACT

The industrial impact of the project is the capability to predict, whether a specific moulding mixture has the right composition and production parameters to provide favourable cooling times, and at the same time, not producing excess of gaseous elements. This knowledge enables the foundry experts to make necessary changes in the production to decrease the susceptibility for gas related casting defects and inadequate surface or mechanical properties.

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