

The role of modelling and simulation in the development of refractory products used in the steel industry

Throughout the entire steelmaking production process, refractory materials play a key role. The functionalities of these materials are manifold, such as maintaining the integrity of furnace vessels and protecting the steel shells from high temperatures, therefore regulating temperature losses. The materials also guarantee a safe transfer of liquid steel from one operational unit to another and, with respect to functional products, have a direct impact on the process and, ultimately, on the quality of the product. The materials are exposed to extreme conditions, including thermally induced mechanical loads and chemical attack. Due to the extreme conditions and the increasing demand on the durability and lifetime of the materials, constant research is required to improve and develop refractory products for the steelmaking industry.

In that respect, modelling and simulation has become an important discipline in the field of refractory materials engineering and development in recent years. We apply state-of-the-art methodologies, enabling us to effectively predict the behaviour of these products in use, meet specific customer requirements, produce innovative solutions to achieve production and cost efficiencies and improve safety. Developments in terms of material description in combination with advanced model approaches were realized to further increase the reliability of these methods. However, constant investment in fundamental research is still necessary to help us understand the complexity of the interdependencies involved.

In this presentation we discuss the application of numerical simulation tools as well as diverse experiments and complementary tools, which support activities relating to the development of refractory products for the steel industry. Several examples throughout the steelmaking process are provided to evaluate the impact on each individual process step. Furthermore, the latest activities connected with selected research topics are presented.