Contribution ID: **160** Type: **Oral Presentation**

Development of Sustainable Silica-Alumina Insulating Refractories for Coke Oven Applications

Tuesday 12 May 2026 14:20 (20 minutes)

The iron and steel industry is widely recognized as a hard-to-abate sector due to its high energy demand and reliance on high-temperature processes. While significant attention is often devoted to primary steelmaking routes, secondary systems such as coke ovens also play a crucial role in overall energy efficiency and environmental performance. In this context, the optimization of refractory materials represents a key opportunity to reduce heat losses, improve process efficiency, and enhance sustainability.

This research project focuses on the development of sustainable insulating refractories specifically designed for coke oven applications. In collaboration with Paul Wurth Italia S.p.A. (SMS group), silica–alumina insulating bricks are produced using locally available raw materials and biomass-derived additives, including sawdust, rice husk, fly ash, and biochar. These secondary materials act as pore-forming agents while simultaneously serving as alternative sources of silica and alumina, promoting lightweight structures and supporting material circularity through the valorization of industrial and agricultural by-products.

The objective is to develop insulating refractory bricks with properties comparable to those of conventional commercial products, while reducing reliance on primary raw materials. Different formulations are investigated, with particular emphasis on the SiO2/Al2O3 ratio, leading to the development of various classes of insulating bricks tailored to specific thermal and mechanical requirements. Target performance includes thermal conductivity values in the range of 0.2-0.3 W/m·K at 800 ℃, cold crushing strength around 1.5 MPa, and bulk density between 0.45 and 0.8 g/cm3. These parameters are selected to ensure adequate insulation efficiency, structural stability, and resistance to thermal stresses under coke oven operating conditions.

By integrating alternative raw materials into refractory design, this work highlights the potential of sustainable material solutions to improve energy efficiency and resource utilization in coke oven operations. Future developments will include a comprehensive environmental assessment to further quantify the potential benefits of the proposed materials within the steelmaking value chain.

Speaker Country

Italy

Speaker Company/University

Università di Genova

Primary authors: Dr CARDELLINI, Alberto (Paul Wurth Italia S.p.A (SMS group)); Prof. ARATO, Elisabetta (Università di Genova); Dr STROBINO, Fabrizio (Paul Wurth Italia S.p.A (SMS group)); CLERICUZIO, Maia (Università di Genova)

Presenter: CLERICUZIO, Maia (Università di Genova)

Session Classification: Circularity and by-product management in the steel industry

Track Classification: EMECR: EMECR 4. Circularity and by-product management in steel industry