Abstract

Everything you always to know about refractories but were afraid to ask

Pr. Jacques Poirier, ECerS 2025 Stuijts Award

Welcome to the extraordinary world of refractories, closely linked to high temperatures.
Without these widely available ceramics, our daily lives would be much less pleasant.
We wouldn't have metals, glass, cement, ceramics... and therefore we wouldn't have cars, airplanes, or the essential objects of everyday life.
The two-sided professional career of Pr Jacques Poirier, an engineer in steel making (1983-2001) then a professor of materials (2001-2025) is dedicated to high temperature ceramics
He transferred his industrial experience and knowledge to high scientific contributions by exploring the relationships between processing, microstructures and properties in a broad range of coarse-grained refractory materials and fine-grained structural ceramics for high and ultra-high temperature applications in the steel, cement and chemical industry as well as in energy applications.
In the 1980s, at the beginning of his career, the selection of refractories was based on empiricism and a trial-and-error approach (refractory materials by chance).
Today, Refractory Science, using high-temperature laboratory testing, modeling, and data mining, allows for optimal selection (refractory by design) and prediction of its performance.

During this conference, Professor Poirier will present a review of his research contributions to high-temperature ceramics, at the crossroads between basic science and industrial applications:

- Thermodynamics and kinetics / corrosion prediction,
- Thermomechanics / masonry design and thermal shock,
- Data mining / impact of refractories on cleanless steel
- Design of microstructures, self healing refractories / performance and durability
- Sustainability, reduction of CO_2 emissions / H_2, recycling
- …..

Based on Jacques Poirier ‘s experience, a global approach for studying the degradation of refractories and improving their performance including industrial expertise, modeling, laboratory tests, identification of mechanisms, prediction of lifespan and optimal choice is proposed.

To conclude, the major future challenges of refractory materials will be addressed, including sustainability, eco-design, self-healing, decarbonization, big data, modeling, artificial intelligence, 3D manufacturing, expert and design tools, as well as the training of future young researchers and industrialists who will have to increase the added value of refractory materials.