

TA-4

Refractory Ceramics and their Industrial Applications

Mohamed A. Serry

Ceramic Department, National Research Centre, 12622-Dokki, Cairo, Egypt

Abstract:

Traditional and advanced refractory-ceramics or refractories are solid brittle, polycrystalline, oxide- and/or non-oxide structural ceramic materials, mainly applied for thermal insulation of industrial furnaces or kilns. These include varieties of shaped and unshaped, dense and lightweight, granular and fibrous as well as acidic, neutral and basic products for application under a wide range of thermo- chemical and mechanical service conditions up to ~1800°C. Therefore, these products should withstand effects of service temperatures without losing their shape and mechanical strength, i.e. volume stability. These should also resist thermal shock (spalling) due to successive heating-cooling cycles as well as wear against thermo- chemical and mechanical attack of the in-contact gas, liquid and solid materials under service conditions. Properties and performance of the refractory-ceramic products under service conditions are basically influenced by their chemical and phase composition as well as microstructure, crystal structure of the co-existing phases and also the processes applied for their manufacture or fabrication.

The refractory-ceramic products or refractories are consumed with different rates in lining the different industrial furnaces, equipment and reactors at 800-1800°C. The main refractory consumer is the steel industry (~70%) and the rest is distributed in descending order between Portland-cement and lime, ceramics, including refractories itself, petroleum-refining and chemical industries, glass and non-ferrous metals (Al, Cu, Zn, Pb, ...). Selection criteria for refractory products adequate for application as back and/or face linings of the different parts of these furnaces are mainly based on their thermo- chemical and mechanical service conditions and also on composition, microstructure and physical properties of the products. Hence, intimate cooperation should be existed between the process-consumer technical staff and refractory-manufacturer research team to develop refractory materials suitable for specific service conditions in the different furnace parts. This would lead to optimize performance, service life and consumption of the refractory linings with increasing rate of production and quality of the fired materials. For instance, service conditions as well as the technically and economically feasible types of refractory-linings, recently recommended for application in steel, Portland-cement and ceramic industries are summarized.