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Dependence between abrasion test conditions and the phase composition of basic refractories

Abrasion resistance is one of the crucial properties that determines durability of the shaped and unshaped refractories under the conditions of prolong contact with solid particles as well as abrasive surfaces for instance in electrostatic precipitators, rotary kilns or blast furnaces.
This work presents the results of abrasion resistance tests for two types of magnesia refractories and three types of magnesia-spinel refractory materials at different temperatures.

The chemical composition of the basic products was determined with the use of XRF technique and the phase composition was measured by X-ray diffractometry. A microstructure of the materials was observed using a scanning electron microscope (SEM). Abrasion resistance at ambient temperature was made according to ASTM C-704:1999 and ASTM G65-04. Simultaneously, abrasion test at elevated temperatures of 1000 ^{o}C was performed.

Abrasion test results for magnesia and magnesia-spinel refractories tested at ambient temperature in which erosion occurred agreed with the results obtained at 1000 ^{o}C where abrasion mechanism of wear took place. Results obtained at ambient temperature for magnesia-spinel refractories with the use of method modeled on the ASTM G65-04 are not consistent with the results from other methods. The tests results showed that abrasion resistance of magnesia refractories increases with the increase of periclase amount and the decrease of secondary phases content both at ambient and elevated temperature. Abrasion of magnesia-spinel refractories measured at ambient temperature in accordance with ASTM C-704:1999 as well as at 1000 ^{o}C is increased if the content of spinel is higher and the amount of periclase is lower.

As presented results show magnesium oxide is the phase which improves abrasion resistance in basic refractories in contrast with magnesia-alumina spinel that adversely impacts this property.

This research was partially supported by ZMR S.A. and within the confines of the project no 11.11.160.603.