DIFK Deutsches Institut für Feuerfest und Keramik GmbH

Computer-Aided Thermochemistry

All tests at our Institute are conducted by experts. Our employees include specialists from the fields of physics, chemistry, and mineralogy as well as material testing and technology.

Further testing methods are:

- Gas Corrosion Test for Reducing Media
- Rotary Kiln Test
- Gas Permeability of Refractories at Elevated Temperature
- Induction Melting Aggregates
- Wedge-Splitting Test
- Quantitative Oxidation Test
- Friction Wear
- Blast Wear
- Thermal Conductivity

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DIFK Deutsches Institut für Feuerfest und Keramik GmbH

We are a central institute with more than 50 years of experience in all areas of refractories technology. We are absolutely committed to neutrality and are therefore a partner to all companies working in refractories technology.

Contact:

DIFK **Deutsches Institut für Feuerfest und Keramik GmbH**

Rheinstr. 58
56203 Hoehr-Grenzhausen
GERMANY

Phone: +49 2624 9433-200
Fax: +49 2624 9433-205
E-Mail: info@difk.de

www.difk.de

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Computer-Aided Thermo-chemistry

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In the course of production and application of refractory materials a lot of chemical reactions proceed resulting in a considerable change of properties, i.e. strength and corrosion resistance. Computer-aided thermochemical calculations by the software package FactSage® open the way for prediction of the equilibrium state at given operating conditions. Thereby, information about possible reaction mechanisms can be obtained even in systems, which are difficult to investigate by lab-experiments and for systems with a very complex chemical composition. Starting point of each calculation is the definition of the system parameters like the composition of the refractory material, the gas composition, the ambient pressure and the temperature or temperature interval. By varying one or more of the system parameters, general tendencies about phase stability and reaction mechanisms can be predicted.
Thus, thermochemical equilibrium calculations are a helpful tool for the definition of process parameters in manufacturing or application of refractories, for the prediction of microstructural alteration during use or for damage analysis.

Example 1

Fig. 1 shows the amount of phases in equilibrium, which are formed in dependence on temperature in a typical MgO-C brick with Al addition. Metallic Aluminium is not stable in the presence of carbon, hence aluminium carbide (Al_4C_3) is formed already at low temperatures. With increasing temperature, Al_4C_3 decomposes at about 1250°C to form spinel (MgO-Al_2O_3) At an ambient pressure of 0.1 bar and temperatures above 1500°C the decomposition of MgO by formation of Mg-vapour is possible. These results are in good agreement with practical experience.

Example 2

Figure 2 shows the saturation concentration of alumina and magnesia in contact with a CaO-SiO_2-slag (C/S = 1.5). As fig. 2 shows, the stability of MgO is much higher than for Al_2O_3 represented by the lower saturation concentration of MgO compared with Al_2O_3.

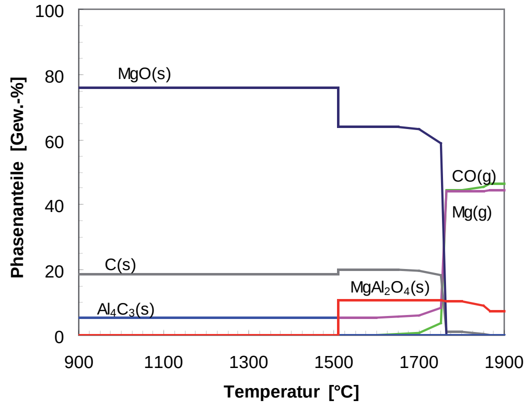

Fig. 1: Phase equilibrium in a typical Al-containing MgO-C-brick.

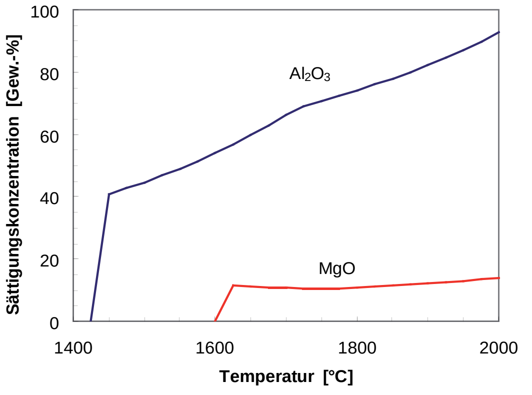

Fig. 2: Stability of Al_2O_3 and MgO in contact with CaO-SiO_2-slag (C/S = 1.5).