A New Method for Slag Infiltration in Refractories Employing the Floating-Zone Crystal Growth Technique

Shepherd, Robert[1] Buhr, Andreas[2] Göbbels, Matthias[1]
[1]FAU Erlangen-Nürnberg, GeoZentrum Nordbayern, Mineralogie, Schlossgarten 5a, 91054 Erlangen, Germany
[2]ALMATIS, Lyoner Str. 9, 60528 Frankfurt, Germany

Chemical corrosion due to slag attack and infiltration into refractories is one of the most important factors in application. The usual method testing a refractory brick with a slag filled cavity placed in a chamber furnace does not really represent the actual situation in use because of the lack of temperature gradient. Other methods employing scaled down industrial furnaces are usually cost intensive and therefore not suitable for larger testing series.

In this study a crystal growth method is used for studying the slag infiltration into refractories. The floating-zone method is a crucible free experimental technique for growing medium sized single crystals. Usually the typical dimensions for grown crystals are 5 – 15 mm diameter and up to 100 mm length. The melt-zone is kept by its surface tension.

The high thermal gradient of 300 - 500 °C/cm can simulate the actual situation in an industrial application, which usually shows a large thermal gradient in the lining.

The transition from the crystal growth set up to the slag infiltration test is achieved simply by exchanging the growing crystal by a suitable refractory rod and introducing a droplet of a slag in the melt-zone. The feed rod used for the crystal growth is not needed.

The temperature can be chosen by arranging the lamp power within a range of 800 to 2000 °C. The only disadvantage of this method is the fact, that the temperature can not be in situ measured during the experiment. The basics of this new method have already been presented by Göbbels & Schmid (2006). In this study a refined calibration in a special set up is presented where the lamp power is correlated with temperature due to suitable calibrations.

The experiments presented were carried out using low cement castables based on tabular alumina from ALMATIS. The castables have a top size of 2 mm.

A synthetically composed calciumaluminate steel ladle slag for Al-killed steel has been the test slag. The amount for the testing experiments was 0.3 g and the infiltration experiments have been carried out at 1650°C for 3 hours in air. In addition time relayed series for 0.5, 1 and 3 hours to study the kinetics were investigated.

After the experiment the geometrical dimension of the slag infiltration and chemical reactions such as newly formed phases were studied by means of optical microscopy, BSE-image, electronprobe-microanalysis (EPMA) and spatial resoluted X-ray diffractometry (GADDS).

This work has shown that the new method is well suitable for studying slag infiltration in refractories. This method includes a high thermal gradient, a free choice of refractory material and slag and a control of the ambient atmosphere. By this a wide area of applications can be covered.

Reference:

Göbbels, M. & Schmid, M. (2006), Slag infiltration in refractories employing a crystal growth method with thermal gradient, Stahl & Eisen Special: Refractories for metallurgy, Nov. 2006, 60

→

Abs. No. **150**
Meeting: **DMG 2008**
submitted by: **Shepherd, Robert**
email: **shepherd@geol.uni-erlangen.de**
date: **2008-05-29**
Req. presentation: **Vortrag**
Req. session: **S16**