

Measurement and Numerical Simulation of Viscosities in Slag-Systems under Gasification Conditions

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Abstract

Silica melts are reflected in many different industrial and natural processes such as slags in steel production and gasification of coal, glass in the glass making industry, lava in the volcanology and in lots of other fields. Rheological properties like the viscosity of this silica melts are really important in all of these processes. A general and good working viscosity model would help all scientists and engineers, who have to simulate and optimize these processes.

First it is important to have the possibility to measure viscosities of slags. A new high-temperature high-pressure rotational viscosimeter is developed for measurements up to 1650 °C and 20 bar. Particularly in relation to the coal gasification process this two parameters are really important, because coal gasification occurs under high temperatures and high pressures. With this new viscosimeter it is possible to measure slag viscosities under realistic gasification conditions. To show that the new viscosimeter works quite good viscosity measurements of a standard glass has been done.

Also a new viscosity model is developed. The model is based on the inner structure of the slag (associates) and consists in existing thermodynamic models. After a detailed literature research the model is developed for the $\text{SiO}_2\text{-Al}_2\text{O}_3\text{-Na}_2\text{O-K}_2\text{O}$ system. The quality of this new model is estimated by comparing calculated viscosity values with measurements found during the literature research and with FactSage 6.2 calculations.

The new viscosimeter was also used to do measurements of three different synthetic slags. These measurements were compared with calculations of the new model and FactSage 6.2.