European Mineralogical Conference
Vol. 1, EMC2012-402, 2012
European Mineralogical Conference 2012

Characterization of convertor slag in terms of slag instability

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Convertor slag, a co-product of the iron metallurgy process, is composed of high-temperature phases, which are reactive over a long period of time and undergo phase transformations what could be hazardous, e.g. because of destruction of concrete constructions containing slag aggregates. The aim of the detailed chemical and mineralogical study of slag was to determine components responsible for slag instability. The most reactive phase in the studied slag is di-calcium silicate (Ca_2SiO_4). Di-calcium silicate is present as non-stabilized form of β-Ca_2SiO_4 (larnite). Two types of larnite were detected in studied samples: larnite characterize by stoichiometric chemical composition and larnite enriched in calcium in comparison to its ideal chemical formula. The other components present in slag are srebrodolskite ($Ca_2Fe_2O_5$) and iron oxides with admixture of magnesium, manganium and calcium, with XRD spectrum lines close to those of wüstite (FeO).
The Basicity Index (BI=CaO/SiO_2) is one of the most important parameter characterizing slag technical properties and stability. It is considered that hydration and disintegration risk is lower in case of slag with lower BI. Results of the study indicate that not the absolute value of the CaO/SiO_2 ratio determines slag properties, but the chemical composition of larnite. If larnite is characterized by a higher than stoichiometric calcium content it is subjected to accelerated decomposition accompanied with release of CaO. CaO released during larnite decomposition in the presence of water undergoes hydration resulting in portlandite $(CaOH)_2$ formation. Crystallization of portlandite causes increase of volume of slag, and lowering of its technical properties.