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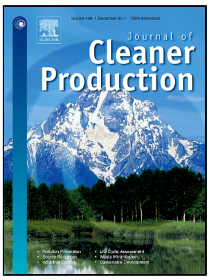

Reducing environmental impacts: The use of basic oxygen furnace slag in portland cement

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Abstract

The technological process of clinkerization is responsible for a high consumption of energy and the release of carbon dioxide (CO_2) to the environment. It is estimated that the cement industry generates, for every tonne of cement produced, around 0.7 to 1 tonne of CO_2, in order to be responsible for 5% of CO_2 global emission, while in Brazil, this corresponds to 1.4%. This study reused the basic oxygen furnace slag, submitted to different cooling processes, for the partial replacement of clinker. Formulations of CPIII portland cement were prepared with substitution of 5.4% by weight of clinker by basic oxygen slag with 53 and 71% amorphous phase. The compressive strength was evaluated at ages 3, 7, 28 and 91 days, determined setting times, hot and cold expansibility. The addition of basic oxygen furnace slag, regardless of the crystallinity degree, provided the cement gains in the initial and final mechanical strength. By adding slag with 71% amorphous phase, the cement presented 29 and 40.4 MPa of compressive strength after 7 and 28 days, respectively; while with the addition of slag with 53% amorphous phase, the cement strength exhibited 31.9 MPa after 7 days and 41.4 MPa after 28 days. The use of BOF slag, as a partial clinker substitute, allows it to reduce pollutant emissions and to achieve a higher energy efficiency without affecting the cement physical-chemical properties.

Highlights:

The use of BOF slag is proposed for the production of portland cement.

Cements with addition of BOF slags showed no expansive character or an increase in water demand and presented higher strength than those required by the standard.

Keywords: basic oxygen furnace slag; clinker; cement; compressive strength

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