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Blast Furnace Slag Cement Clinker Production Using Limestone-Hot Blast Furnace Slag Mixture
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Abstract

The higher production of steel lead to increase in blast furnace slag (BFS) waste which is the by-product of pig iron production. It is due to the demand of steel and concrete around the world for residential and corporate office. The tapping temperature of BFS waste is 1500 °C, hence the amount of heat ex- posed to the atmosphere is enormous. Reusing slag and heat waste from hot slag contributes to green economy. Using appropriate mixing composition, BFS and limestone mixture can be used for green cement production. This works explores the potential to convert slag waste into cement clinker using heat recovered from blast furnace of iron production. BFS and limestone was mixed at specific ratio according to their phase diagram for mentioned purpose. The mixing composition of BFS and limestone is varied at weight percentage of 60, 70 and 74% calcium oxide (CaO). The results show the alite and belite phase present in the slag clinker under XRD characterization and the percentage of weight loss increase after annealing process. BET analysis shows the higher addition of CaO results in higher pore volume, which is proving the high percentage of weight loss. It is observed from the annealing process that the final composition of slag clinker changed. This study shows that by heating BFS with limestone has potential to produce cement clinker at the mixing composition of 74% CaO. © 2023, The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd.

Author Keywords

Blast furnace slag; Cement clinker; Waste heat

Index Keywords

Blast furnaces, Lime, Limestone, Metal recovery, Mixing, Waste heat; Annealing process, Blast furnace slag cements, Cement clinker, Clinker production, Corporate offices, Green economies, Iron production, Slag mixtures, Slag wastes, Weight loss; Slags

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References

- **Push-ing the Limits of the Maximum Punch-Through Design with an Advanced Buffer for Thin Wafer IGBTs**
(2020) *Proc. Int. Symp. Power Semicond. Devices Ics*, pp. 509-512.
- **Push-ing the Limits of the Maximum Punch-Through Design with an Advanced Buffer for Thin Wafer IGBTs**
(2020) *Proc. Int. Symp. Power Semicond. Devices Ics*, pp. 509-512.
- Li, Y., Liu, Y., Gong, X., Nie, Z., Cui, S., Wang, Z., Chen, W.
Environmental impact analysis of blast furnace slag applied to ordinary Portland cement production
(2016) *J Clean Prod*, 120, pp. 221-230.
- Joyce, A.O.
Iron and steel slag, U.S

(2021) *Geological Survey*,

- Gao, T., Shen, L., Shen, M., Liu, L., Chen, F.
Analysis of material flow and consumption in cement production process
(2016) *J Clean Prod*, 112, pp. 553-565.
- Kasai, E., Akiyama, T., Purwanto, H.
Process analysis of the effective utilization of molten slag heat by direct blast furnace cement production system
(2010) *ISIJ Int*, 50 (9), pp. 1319-1325.
- White, J.F., Lee, J., Hessling, O., Glaser, B.
Reactions between liquid CaO-SiO_2 slags and graphite substrates
(2017) *Metall Mater Trans B*, 48 (1), pp. 506-515.
- Kurdowski, W.
(2014) *Cement and Concrete Chemistry*,
Springer, Netherlands
- Telschow, S.
(2012) *General Rights Clinker Burning Kinetics and Mechanism*,
APA
- Senkov, O.N., Chakoumakos, B.C., Jonas, J.J., Froes, F.H.
Effect of temperature and hydrogen concentration on the lattice parameter of beta titanium
(2001) *Mater Res Bull*, 36, pp. 1431-1440.

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