Development of Fluxed Iron Oxide Pellets for Steel Making Utilizing Waste Materials

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Abstract

Lump lime is conventionally used as a flux material in steel making. However, use of burnt lump lime often creates problem in operation due to its high melting point, poor dissolution property, fine generation tendency and hygroscopic nature. Lime in combination with iron oxide may form a low melting oxidizing slag and makes the refining process faster. In this context, NML has developed a novel process of making fluxed pellet utilizing waste materials from steel plant without using any binder and without firing. The developed pellet shows very good cold crushing strength (30Kg/pellet), drop impact strength (150) and tumbler index (98%). The high temperature properties of the pellets like thermal shock resistance, melting point (1180^{o}C) and dissolution time (30-60 sec) in molten bath are also found to be excellent. Performance of pellets has been assessed in a simulated oxygen bottom blown process in laboratory scale. Very fast decarburization and dephosphorization, improved metallic yield and decrease in oxygen consumption with controlled foaming are observed. Overall, in the present study the lime-fluxed iron ore pellets, developed in a binder-less room temperature process utilizing waste materials of steel plant are found to possess good cold handling and thermal properties, and favorable melting and refining characteristics, to warrant their application as a partial/complete substitute of the traditional scrap-lime combination in basic oxygen steel making or faster refining in steel making process.

Lump lime is presently used as a flux material in steel making. However, use of burnt lump lime often creates problem in operation due to its high melting point, poor dissolution property, fine generation tendency and hygroscopic nature. Since, Fe_2O_3-CaO (78:22) has a eutectic at 1206ºC, the combination of iron oxide and lime may yield a low melting flux. In this study, fluxed pellets were developed through a novel process without firing and without binder. Pellets were made using waste iron oxide fines (-30mesh) and lime fines and subsequently, treated with waste gas for strength development. The pellet shows very good cold crushing strength (30Kg/pellet), drop impact strength and degradation index in tumbler test (2%). The high temperature properties of the pellets like thermal shock resistance, melting point (1180°C) and dissolution time (30-60 sec) in molten bath are also found to be excellent. Performance of pellets in a simulated oxygen bottom blown process in laboratory scale shows very fast decarburization and dephosphorization, improved metallic yield and decrease in oxygen consumption. Overall, the process appears to have very good application potential of replacing partial or complete lump lime charging, faster refining as well as waste utilization.

Lump lime is presently used as a flux material in steel making. However, use of burnt lump lime often creates problem in operation due to its high melting point, poor dissolution property, fine generation tendency and hygroscopic nature. Since, Fe_2O_3-CaO (70:30) has a eutectic at 1230oC, the combination of iron oxide and lime may yield a low melting flux. In this study, fluxed pellets were developed through a novel process without firing and without binder. Pellets were made using waste iron oxide fines (-30mesh) and lime fines and subsequently, treated with CO_2 containing gases for strength development. Performance of pellets was assessed in a simulated oxygen bottom blown process in laboratory scale. Lime-fluxed iron ore pellets, developed in a binder-less room temperature process utilizing waste materials of steel plant are found to possess good cold handling and thermal properties, and favorable melting and refining characteristics, to warrant their application as a partial/complete substitute of the traditional scrap-lime combination in basic oxygen steel making or faster refining in steel making process.