

Optimization of Sintering Process with Deteriorating Quality of Iron Ore Fines

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Abstract : Blast Furnace performance mainly depends on the quality of sinter as a major portion of iron-bearing material occupies by it hence its quality w.r.t. Tumbler Index (TI), Reducibility Index (RI) and Reduction Degradation Index (RDI) are the key performance indicators of sinter plant. Now it became very tough to maintain the desired quality with the increasing alumina (Al_2O_3) content in iron fines and study is focused on it. Alumina is a refractory material and required more heat input to fuse thereby affecting the desired sintering temperature, i.e. 1300°C . It goes in between the grain boundaries of the bond and makes it weaker. Sinter strength decreases with increasing alumina content, and weak sinter generates more fines thereby reduces the net sinter production as well as plant productivity. Presence of impurities beyond the acceptable norm: such as LOI, Al_2O_3 , MnO, TiO_2 , K_2O , Na_2O , Hydrates (Goethite & Limonite), SiO_2 , phosphorous and zinc, has led to greater challenges in the thrust areas such as productivity, quality and cost. The ultimate aim of this study is maintaining the sinter strength even with high Al_2O_3 without hampering the plant productivity. This study includes mineralogy test of iron fines to find out the fraction of different phases present in the ore and phase analysis of product sinter to know the distribution of different phases. Corrections were done focusing majorly on varying $\text{Al}_2\text{O}_3/\text{SiO}_2$ ratio, basicity: B2 (CaO/SiO_2), B3 ($\text{CaO}+\text{MgO}/\text{SiO}_2$) and B4 ($\text{CaO}+\text{MgO}/\text{SiO}_2+\text{Al}_2\text{O}_3$). The concept of Alumina / Silica ratio, B3 & B4 found to be useful. We used to vary MgO, $\text{Al}_2\text{O}_3/\text{SiO}_2$, B2, B3 and B4 to get the desired sinter strength even at high alumina (4.2 - 4.5%) in sinter. The study concludes with the establishment of B4, and $\text{Al}_2\text{O}_3/\text{SiO}_2$ ratio in between 1.53-1.60 and 0.63- 0.70 respectively and have achieved tumbler index (Drum Index) 76 plus with the plant productivity of 1.58-1.6 t/m²/hr. at JSPL, Raigarh. Study shows that despite of high alumina in sinter, its physical quality can be controlled by maintaining the above-mentioned parameters.

Keywords : Basicity-2, Basicity-3, Basicity-4, Sinter

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