



STRENGTH OF CHROMITE BRIQUETTES AND ITS EFFECT ON SMELTING OF CHARGE CHROME / FERRO CHROME

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ABSTRACT

This paper deals with various factors affecting the strength of chromite briquettes which plays a vital role in the smelting of charge chrome / ferro chrome production.

Appropriate briquetting parameters like molasses and lime binder level, molasses quality, particle size distribution and segment condition etc. are essential to guarantee quality briquettes in the successful use of briquette and chromite ore fines.

In developing a technology for briquetting of chromite ores, it is important not only to study the grain size characteristics of the chrome ore fines but also to make an informed choice of the type and quality of the binder and the condition for producing a physically and chemically competent green and cured briquette.

This paper also describes the effect of strength of briquettes on various parameters of charge chrome production as the use of quality briquettes in the production of high carbon ferrochrome alloys has a number of operational, metallurgical and economic advantages.

It is also a requirement for submerged arc furnace operation that the charge be adequately porous to allow gaseous products of the reduction reaction to escape from the furnace charge burden without hindrance. Otherwise, furnace material would erupt causing electrodes and furnace other equipments damage and risking the safety of the work force. The briquette, because it replaces lumpy charge but has an advantage of smaller size, allows for an uniform and porous charge so that the ascending gaseous products can escape freely.

Finally this paper deals with furnace operational results with varying proportion of briquettes having same strength.

1. INTRODUCTION

With the use of briquetting process for agglomeration of fines fractions of chromite ores, requirement of lumpy ores for smelting for the production of ferro chrome / charge chrome has been reduced to a large extent over a period of years.

To improve the strength of briquettes, it is not only important to study the mineralogical characteristics & grain size of chromite ore fines but also it is required to select the type and quantity of the binder & the condition to preserve raw briquettes.

Variations in quantity of available chromite ore fines imply that their availability to briquettes is a dynamic problem. Appropriate briquetting parameters to guarantee quality briquettes are essential in the successful use of briquetted chromite ore fines.

2. STRENGTH OF BRIQUETTE A CASE STUDY

During the period 2004-2005 & 2005-2006 at IMFA, Choudwar, Orissa, India, we observe considerable improvement for the strength of briquette compared to previous period for which data is given in Annex. -1.

The following are the parameters, which play major role in deciding the quality of briquettes and we tried to bring favorable changes in all those aspects:

- Grain size of chromite ore fines
- Quantity & quality of binders
- Curing time
- Drying efficiency

Out of the above, it is observed that grain size of fines and curing time plays a vital role to improve strength of briquettes having binder percentage and quality remaining constant.

Study includes the period from 2003 April to 2006 Mar, during which it is clearly observed gradually the strength improved compared to the initial period of year 2003 – 2004 and clearly visible from the data presented below in table – 1.

Table 1: Study during the period Apr'03 to Mar'06

Year	Month	Avg. Strength (Kg/cm ²)	Avg. Grain Size (%ge Of Fines -0.25mm)	Avg. Curing Time (In Days)
2003 - 2004	Apr – Jun	41	55	6
	Jul - Sep	35	56	7
	Oct – Dec	39	57	9
	Jan – Mar	45	57	9
2004 – 2005	Apr – Jun	54	58	17
	Jul - Sep	50	58	13
	Oct – Dec	52	65	10
	Jan – Mar	56	68	10
2005 – 2006	Apr – Jun	55	67	18
	Jul - Sep	57	71	19
	Oct – Dec	52	66	13
	Jan – Mar	58	67	13

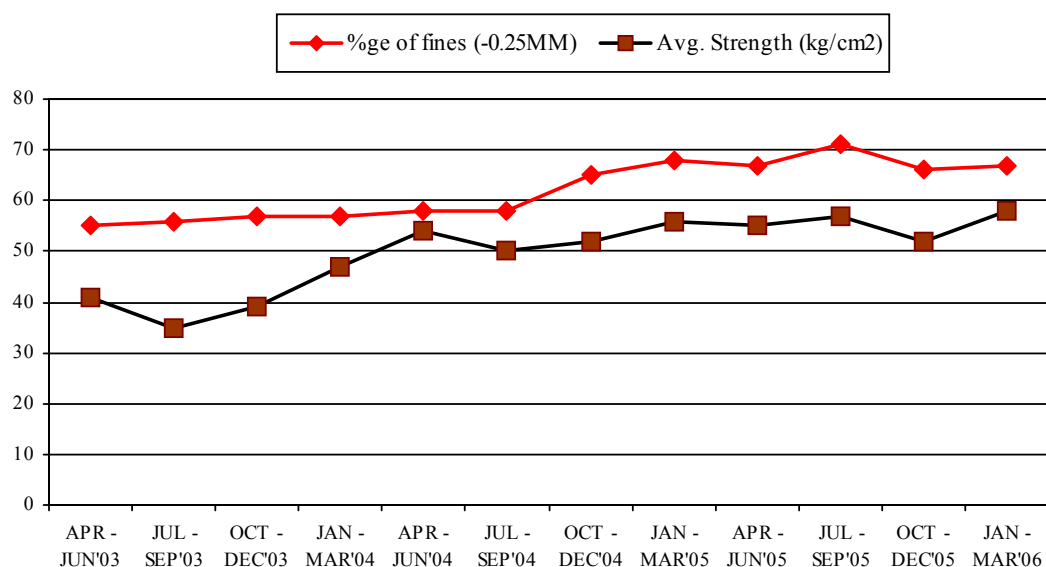


Figure 1: Chrome ore fines grain size vs. briquette strength

The graph in fig.1 shows a significant improvement in the strength of briquettes when grain size remained more percentage below 0.25mm, preferably 60 – 75% in general as per our observation. It is also observed that if it exceeds 75%, again it is a problem affecting the strength consuming more quantity of binder.

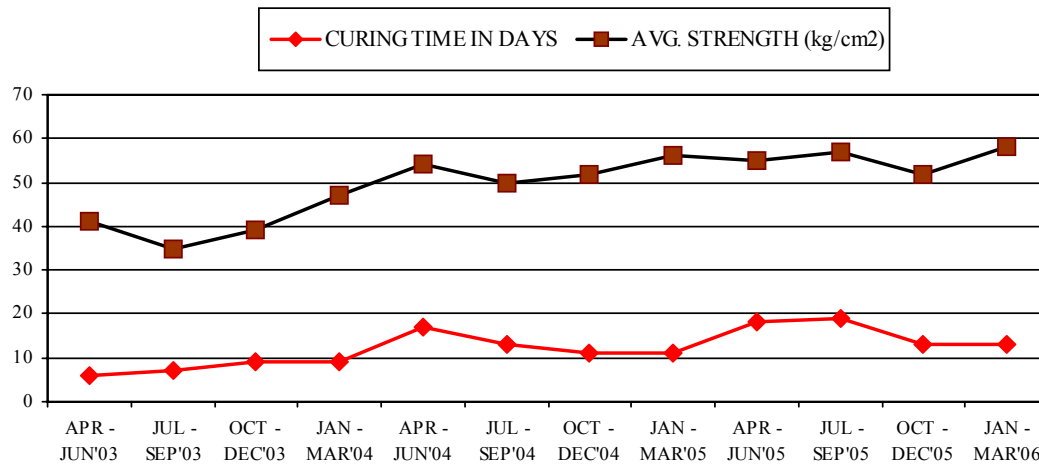


Figure 2: Briquettes curing time vs. strength

As shown in figure 2, it is clearly evident that along with grain size, curing time also played a major role, which was gradually increased in last two years. Mostly curing time was maintained minimum of 7 days and on an average through out the studied year and it is clear that having correct grain size by maintaining minimum required curing time we can achieve the required strength (>50 kg/cm²).

3. EFFECT OF BRIQUETTE STRENGTH ON PROCESS PARAMETERS

Having good briquette strength it could be possible to increase the proportion of briquettes in the burden from 55 to 65%, which fetched cost reductions by restricting lumpy ores, which are costly.

By having briquettes with good strength there has been overall improvement in operational aspect of charge chrome production. This can be clearly seen in the following graphs, which shows the trend of improvement after increasing the strength of briquettes.

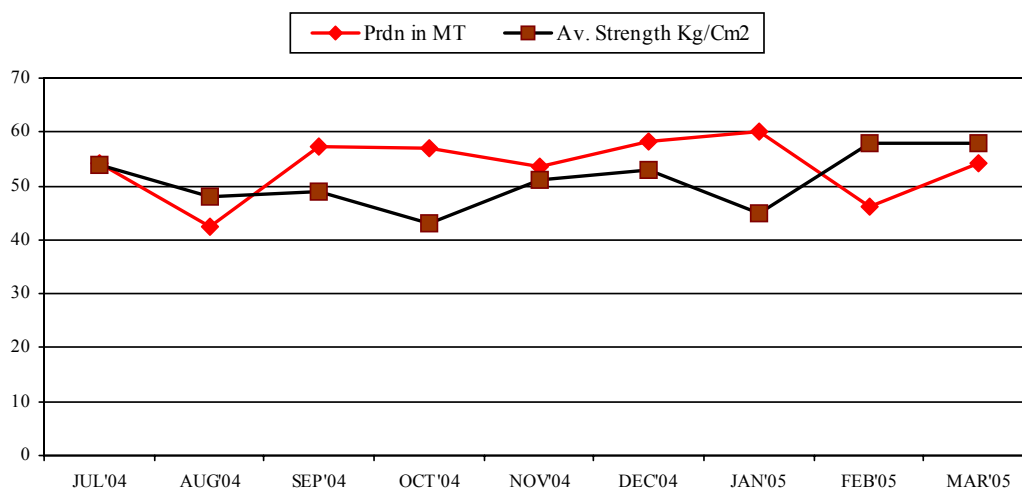


Figure 3: Charge chrome production vs. briquette strength (Production figure is represented in multiple of 100)

This is attributed, in part to an enhanced thermo chemistry of a closely sized briquette feed consisting of temporarily bound fines with a higher specific surface area which in turn leads to improved reaction kinetics.

There is definite upward trend in production output with increasing briquette strength. Although this cannot be entirely attributed to the higher briquette strength, the use of higher proportionally briquette is associated with better-sized feed, which leads to improvements in furnace operating conditions.

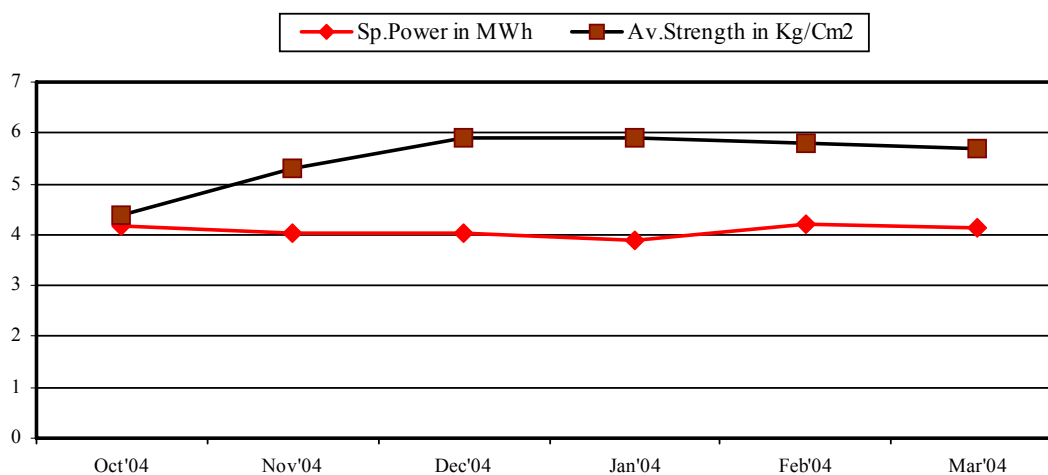


Figure 4: Sp. Power per MT of charge chrome vs. briquette strength (Average strength is in multiple of 10)

Graph in fig.-4 shows a significant improvement in energy utilization efficiency at higher strength if briquettes.

It is also a requirement for submerged arc furnace operation that the charge to be adequately porous to allow gaseous products of the reduction reactions to escape from the furnace charge burden without hindrance. Otherwise, furnace material would erupt causing electrode assembly damage and risking the safety of the work force. The briquette as it simulates lumpy charge but has an advantage of a smaller size, allows for a uniform and porous charge so that the ascending gaseous products can escape freely. The combined result of the above is an improvement in production out put, which have a positive impact on related key efficiencies as the briquette proportion is increased.

4. CONCLUSION

Grain size and curing time plays greater role for increasing the strength of briquettes.

Higher proportions of briquettes make a homogeneous feed size and grade thus improving furnace-operating conditions.

Briquettes with optimum strength facilitates to increase its proportion in the burden which yields massive cost advantages improving the overall process economic viability.

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