International Journal of Scientific Engineering and Technology (ISSN : 2277-1581)
Volume 2 Issue 4, pp : 288-290 1 April 2013

Improving Thermal Efficiency Of Push Type Furnace In A Hot Re-Rolling Steel Mill By Direct Method : Case Study

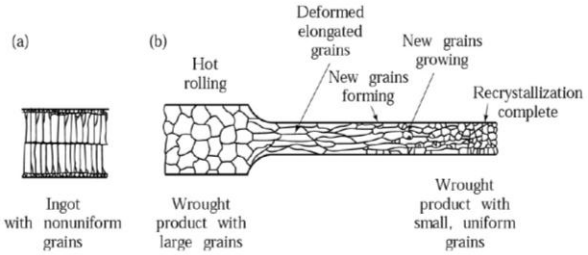
Jeetendra Mohan Khare, Sandip Kumar Mishra, Shashank Shrivastava
Faculty of Mechanical Engg Department SRGI ,Jhansi (U.P.)
jmkhare2010@rediffmail.com

Abstract

Rolling is the process of reducing the thickness or changing the cross-section of a long work-piece by compressive forces applied through a set of rolls. Rolling accounts for about 90% of all metals produced by metalworking processes. The purpose of Rolling is to convert larger sections into smaller sections, which can be used directly in as rolled state or as stock for working through other processes. As a result of rolling, the coarse structure of cast ingot is converted into a fine grained structure.

Introduction

In this process the raw-material ingots are first heated to the above re-crystallization temperature (rolling temperature) inside the push-type furnace and then passing the hot-ingot through a set of rolls, rotating in opposite directions at a uniform peripheral speed. The space between the rolls is adjusted to conform to the desired thickness of the rolled section, and the same is always less than the thickness of the ingot being fed. The rolls thus squeeze the passing ingot to reduce its cross-section and increase its length.



The process is illustrated in figure, which shows the changes that takes place in the grain structure of the metal as it passes through the rolls. As a result of squeezing, the grains are elongated in the direction of rolling and the velocity of the material at exit is higher than

that at the entry. After crossing the stress zone the grains start refining. Temperature uniformity is important in all rolling operations. Since it controls metal flow and plasticity.

In rolling, the quantity of metal going into a rolls and out of it is the same, but the area and velocity are changed.

$$\mathbf{Q_1 = Q_2}$$

$$A_1V_1 = A_2V_2$$

$$A_{1/} A_2 = V_{2/} V_1$$

$Q_1 =$ Quantity of metal going into rolls
$Q_2 =$ Quantity of metal leaving the rolls
$A_1 =$ Area of an element in front of rolls, in m^2
$A_2 =$ Area of an element after rolling, in m^2
$V_1 =$ Velocity in the element before the rolls, in m/s
$V_2 =$ Velocity in the element after the rolling, in m/s

The rolling operations in an integrated steel plant can be classified in two sections,

primary and finishing. The primary operations produce steel products from raw material

and the finishing operations control the final specifications of the orders. We focus our

attention on the hot rolling mill area of the primary operations. This mill transforms large

bars of steel, called slabs, into I-section, C-section etc.

The Objectives of improving the efficiency of furnace

The re- rolling furnace is used for heating the raw-material below than the melting point temperature to get the necessary deformation caused by the set of rolls in rolling mill.

Objectives that should be gained by improving the efficiency of push-type furnace used in the rolling are as -

a) Maximum the number of billets passed through the furnace.
b) Minimizing the time travel by the billet inside furnace.
c) Regular flow of raw- material.
d) Minimizing the production costs.
e) Maximizing the production rate of mill.

Methods used for determining the efficiency of push-type furnace-

Furnace efficiency of re-heating push type furnace can be calculated by two different methods. The different methods for determining the efficiency of the furnace are-
1.Direct Method for determining the efficiency Furnace efficiency by direct method is the ratio of heat in the stock to the heat of fuel consumed. Heat of fuel consumed can be calculated by total quantity of fuel burned in liter/hour.
Heat in the stock(Q)

Thermal efficiency = Heat of Fuel consumed

where $\mathbf{Q = m \times Cp(t_1 - t_2)}$

Q = Quantity of heat of stock in kca
M = weight of the stock in kg.
Cp = Mean specific heat of the stock in kcal/kg in ^oC
t_1 = Final temperature of stock desired in ^oC
t_2 = Initial temperature of the stock in ^oC

2.Indirect Method for determining the efficiency Furnace efficiency by indirect method is calculated by subtracting all form of heat losses from heat input.. Various parameters of furnace are to be measured such as-

a. Sensible heat loss in flue gas
b. Loss due to evaporation of moisture in the fuel
c .Loss due to evaporation of water formed from h2 in fuel
d. Heat loss due to opening.
e. Heat loss through Skin .

Thermal efficiency = (100 - all forms of heat losses)

PROBLEM FORMULATION, EVALUATION

K.L.STEEL(P) LIMITED, GAZIABAD-

The K.L. group was established in 1948. An attitude of total commitment to customer satisfaction has propelled us to grow and diversify into a big business house with a group turnover of USD300million / annum. The company is a conversion agent of steel Authority of India Ltd.. The raw material used is billet, Bloom and Ingot purchased from Steel Authority of India Limited and others. Each lot of purchase tested before using as input to ensure quality.

K.L. steel is the manufacturers of ISI Structural Steel section i.e. Angle, Channel, Joist, H-Beam, H.R. Flat & M.S./G.I Steel tubes having annual production capacity of 122000 MT on single shift basis. The company is a BIS license holder of IS:2062:1999 CML/8667088 (acceptance of STI/2062:2006/R-1/8 June 2007), IS:15647:2006, CML/8785308, IS:1239:Part-I:2004 CML/8650786. The Company is an ISO approved company having registered supplier and approved vendor of the following party:

1. Steel Authority of India Ltd.
2. U.P State Agro Industries Corp. Luck now
3. H.P State Civil Supply Corp. Ltd. Shimla
4. Uttaranchal Peyjal Nigam, Dehradun
5. U.P Jal Nigam, Lucknow
6. Military Enginner Service, Palam
7. Enginners India Ltd. Panipat
8. Indian Oil Corporation Ltd. Panipat
9. Bharat Oman Refineries Ltd., Madhya Pradesh
10. National Thermal Power Corporation Ltd.

RESULTS

The results obtained by the two different methods used to determine the push type furnace efficiency are as-

Sr No	**Description**	**Present method**	**Direct method**
1	Thermal **efficiency**	**24.02%**	**25.43%**

Conclusion-

As we are seeing that the company, what the present thermal efficiency of push-type furnace by indirect method is 24.02%.

If keeping in the view of current research paper, rather using indirect method, if we use the direct method than we can increase the thermal efficiency of push-type furnace i.e, 25.43%.

By increasing 1.41% of efficiency of the furnace we can save the lot of energy (thermal,chemical & electrical) that is being as in form of input to run the rolling mill

References

I. K.L. steel (p) limited, Ghaziabad
II. Cowling, P. (1995), "Optimization in Steel Hot Rolling", Optimization in Industry, Wiley Fabian, T. (1958), "A Linear Programming Mode1 of Integrated Iron and Steel
III. Production", Management Sciences. 4, 415-449 Narasimhan, S.L. and Panwalkar, 1984, "Scheduling in a two-stage manufacturing
IV. process", In~emationaJl journal of Production Reserch, 22, 555-564,
V. Narasimhan, S.L. and Mangianelli, P.M. (1987). "A Comparison of Sequencing Rules for a Two-Stage Hybrid Flow Shop", Decision Sciences. 18, 250-265.
VI. Petersen, CM., Sorensen, K.L., and Vidal, R.V.V. (1992). 'Inter-Process Synchronization in Steel Production", International journal of Production Research. 30,(6), 1415-1425
VII. Rajendran, C. and Chaudhun. D. (1992). "A Multi-stage Parallel-Processor Flow shop Problem with Minimum Flow time", European JournaI of Operational Research. 57, 111-122