and converted to SHE by taking in to account of algebraic value of ±0.24 volts.

The reaction that is taking place at anode is

$4Fe^{++} + 9H_2O \rightarrow 2Fe_2O_3.3H_2O + 12H^+ + 4e$

At cathode the following reactions are allowed to take place

$3Fe^{3+} + 5H_2O + e$ -------- $Fe_3O_4.H_2O + 8H^+$

$3Fe^{3+} + 6H_2O + e$- ---------- $Fe_3O_4.2H_2O + 8H^+$

$3Fe^{3+} + 7H_2O + e$ -------- $Fe_3O_4.3H_2O + 8H^+$

$3Fe^{3+} + 8H_2O + e$ -------- $Fe_3O_4.4H_2O + 8H^+$

$2H_2O + O_2 + 4e = 4OH$

Variables studied are

Concentration (Fe^{2+}): 56,45, 35, 25 gpl

Temperature (°C): 30, 50, 70, 80, 90

Current density: 50, 100, 150, 200 A/m²

From the Tables 1 & 2 it can be inferred that anode potential is independent of product layer thickness.

Table 1: Effect of current density on anode potential, quantity of current and product layer thickness at 30°C, 56 gpl with SS system.

Current	C.D A/m²	A.P			Product layer thickness		
		20 sec	60 sec	120 sec	20 sec	60 sec	120 sec
0.25	50	0.272	0.272	0.271	0.086	0.068	0.067
0.5	100	0.27	0.269	0.269	0.135	0.134	0.135
0.75	150	0.275	0.275	0.274	0.206	0.206	0.205
1.0	200	0.269	0.268	0.268	0.269	0.268	0.268

Table 2: Effect of temperature (70°C)

Current	C.D A/m²	A.P			Product layer thickness		
		20 sec	60 sec	120 sec	20 sec	60 sec	120 sec
0.25	50	0.271	0.271	0.270	0.068	0.068	0.067
0.5	100	0.272	0.271	0.271	0.136	0.135	0.135
0.75	150	0.269	0.269	0.269	0.202	0.202	0.202
1.0	200	0.271	0.271	0.271	0.271	0.271	0.271

Similarity other results indicated that cathode potential is not dependant on product layer thickness and both anode and cathode reactions are under activation control.

On the other hand both anode potential and cathode potential are same at higher current of large charge passed >150 A/m² and the reaction tends to be under diffusion controlled at 200 A/m².

AP-76 (W-231)

Mechanically Induced Reactivity in Boehmite (γ-AlOOH)

T.C. Alex[1], Rakesh Kumar[1], Ansu J. Kailath[1], S.K. Roy[2] and S.P. Mehrotra[3]

[1]National Metallurgical Laboratory, Jamshedpur, PIN 831007, India

[2]Metallurgical & Materials Engineering Department, Indian Institute of Technology, Kharagpur PIN 721302, India

[3]Materials & Metallurgical Engineering Department, Indian Institute of Technology, Kanpur PIN 208016, India

E mail: tc_alex@yahoo.com

Boehmite (γ- AlOOH) is widely used as a precursor material for the industrially important transition aluminas. Effect of mechanical activation on the thermal transformation of boehmite into other phases has been investigated and results are presented in this paper. Boehmite samples, prepared from gibbsite by thermal decomposition, were mechanically activated (MA) up to 4 hours in a planetary mill. Thermal analysis (TG-DTA and DSC), XRD and FTIR were used as main techniques to study the transformations. X-ray diffraction patterns showed formation of no new phase. A steady decrease in peak intensities and broadening of peaks with increase in MA time indicated structural degradation. The changes in the FTIR spectra with MA also supported this. The first endotherm in the DTA pattern, between 70 and 200°C, was found to correspond to the removal of physically adsorbed water. The peak temperature of this endotherm increased as a result of MA. Noticeable weight-loss in the temperature range 200-350°C, is associated with the condensation of equatorial Al_2OH groups. As temperature is raised above 350°C the transition to γ-Al_2O_3 starts with the condensation of other Al-OH groups. These two stages clearly manifested with different slopes in the TG profile, move towards a single event with increase in MA time. As a result of MA for four hours, boehmite to γ-Al_2O_3 transition temperature decreased from 522°C to ~ 474°C. For samples which are MA for less than 1 hour, no thermal event occurred above 600 °C and up to 1200°C. Beyond 1 hour of MA, an exotherm began to emerge and evolved in to a fully developed one after 4 hours of milling. Its temperature of occurrence decreased from 1040 °C for 90 min. milled sample to 1000 °C for 240 min. milled sample MA. DSC studies has been

confined to the temperature regime corresponding to the boehmite to γ-Al_2O_3 transition i.e 300-700°C. The enthalpy of transformation is decreased from around 160 J/g to around 25 J/g after 240 minutes of activation.

AP-77 (G-285)

Infrared Based Measuring and Control System for Cutting the Bloom at Desired Length in 3 Strands Caster

M.R. Khare*, R. Jain, A. Bandyopadhyay**, H. Rao** and Madhusudan****

* RDCIS, SAIL, Ranchi-834002

** Bhilai Steel Plant, SAIL, Bhilai-49001

E-mail: rdcisbspc@sail-rdcis.com

The paper describes the development of low cost, infrared based bloom length measuring and control system for reducing the wastage of high quality steel in caster of Bhilai steel plant. Earlier number of length measuring systems such as contact type, shaft encoder, photo sensor based were tried but could not cut the bloom at desired length because of slippage, sparkles during cutting and resulting into generation of huge Rail scrap and yield loss. Infra red system is not harmful to eyes as Laser, it does not need any calibration as in case of Shaft encoder, doesn't influence due to high luminosity of metal as case for Photo sensor. The error in cutting is reduced from + / -100 mm to 0 to + 25 mm. The cost of installed system is only Rs. 5000/- with a pay back period less than a shift and an annual monetary gain of Rs. 5 crores.

Introduction: Continuous caster-4 of Bhilai steel cast blooms in three strands and they are cut into smaller pieces by gas cutting in order to fulfil the demand of Rail Mill and other external customers. Over length blooms produces scrap at rail mill and also jam the reheating furnaces of mill while short length bloom reduces the yield. The external factors attributes error in the cut length therefore to cutting the bloom at desired accuracy is challenging task. Earlier the bloom length was measured by using a measuring scale installed just adjacent to roll table. As soon as front end of bloom crosses desired length then gripping /cutting activities starts. After cutting, the gas cutting torch trolley return to its initial rest position and ready for next cutting cycle.

Experimental : A system is designed and developed for measuring the bloom that undergoes with a wide variation in temperature at cutting stage by using an infra red based length system as shown in and put into practice.

Why IR sensing: In industry light signals from various sources affect the photo sensor. Therefore infra red sensor preferred while ultra violet emitter produces signal of lower wavelengths and it is dangerous for living things. IR Infra red LED and photo detectors are fast acting devices and the effective range of an IR beam system is thus determined by peak current fed into transmitting emitting diode. Infra red radiation is not harmful to eyes as Laser is , it does not need any calibration like Shaft encoder, doesn't influence due to high luminosity of metal as photosensor It is worth mention that the human eye is sensitive to a range of light radiation. It has a peak spectral to the colour green, which has a wave length of about 550 nm is pleasant to retina, but has a relatively low sensitive to the colour violet (400 nm) at one end of the spectrum and dangerous to retina and to dark red (700 nm) at other. Photodiodes also have spectral response characteristics and these are determined by the chemistry used in the semiconductor junction material.

Approach: IR wave generation and transmission and IR receiver and code detection. Due to characteristics of alloy of high intensity GaAlAr, it generates pulse in infrared region and its peak emission response is at 940 nm. IR LED is used to transmit coded invisible light signal, which is detected by a matching IR diode (and subsequently decoded) in a receiver system some distance away.

Working of IR based System : The system works on sampling principle. For example normal casting speed of bloom is 0.6 m /min (10 mm /sec.) With this speed, bloom takes 1 second to pass 10 mm distance. Maximum speed of bloom may be 50 mm /s. Tolerable measuring error is 10 mm. Therefore for crossing 10 mm distance, bloom takes 200 ms. Therefore, practical IR beam system need not to be turned ON continuously but only needs to be turned on for short duration at repletion period of 950 ms. Sample period should be less than 950 ms but greater than period of tone frequency.

The LED heats up faster than it cools off. On time 25 µs off time 25 ms and need not operate in continuous mode. At fixed interval a burst say 200 % of peak current is able to drive the IR diode to generate IR pulse.

There are 8 IR receivers with a single IR emitter have been put either side of roll table. As soon as IR waves are interrupted by bloom., a pulse is generated to actuate the gripper. The bloom length can be adjusted by means of bloom length selector switches. The different bloom length are indicated by LED inn display unit.

Results and Discussion : Bloom cut by using IR sensor are more accurate compare to contact type system.. An error from