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ASM International, Pune Chapter

Chapter News Letter

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EDITORIAL...

ASM International, Pune Chapter

Welcomes you to the Febraury 2015 issue of Newsletter. Pune Chapter successfully conducted a three day training programme on Failure Analysis. Technical sessions on Recent Developments in Automotive Steel and Special Bar Quality Steel, Design with Powders, and Modern Approach to the Quality Control of HT Processes Based on CQI-9 Requirements were successfully conducted. Technical Article on Carburizing Atmospheres by Dattatreya Laxman Joshi is featured in this issue. …Louis Vaz

Regards,

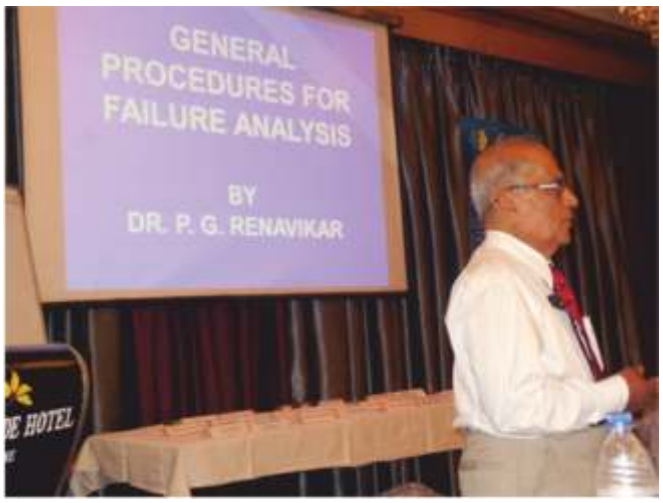
Louis Vaz
Editor

Training Program on Failure Analysis

A three day training program on "Failure Analysis" was organised by ASM Pune Chapter from 6th to 8th November 2014, at Pride Hotel, Pune. The objective of this program was to impart systematic analysis of failures and avoid further failures by getting to the root cause.

Topics covered were General procedures for Failure Analysis, Stress and Types of Failures, Ductile and Brittle Failures, Fatigue Failures, Wear Failures, Corrosion Failures, Failures of Gears, Shafts & Bearings, Failures of Springs, Fastners & Tools and Case Studies.

The faculty was headed by Dr.P.G.Renavikar and ably supported by Mr.A.R.Arankalle, Mr.S.M.Phansalkar, Mr.Udayan Pathak, Mr.Max Babi, Mr.Rahul Gupta, Mr.S.G.Kulkarni and Mr.S.M.Phansalkar. They are all ASM PUNE Chapter members with each having more than 25years of industrial experience.



Dr.Renavikar during his presentation

There were 41 delegates for this program. The program was well received by them with lot of interactions. Failure cases in the field were

A section of the delegates for Failure Analysis training programme.

brought in by the participants and these were scientifically diagnosed by the faculty and the participants.

Technical Presentation on Recent Developments in Automotive Steel and Special Bar Quality Steel -

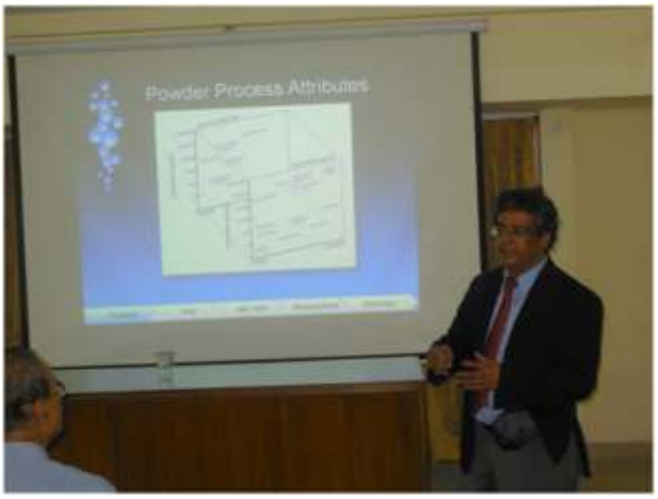
A Technical Presentation was arranged by ASM Pune Chapter and Gerdau Special Steels on the 14th of November 2014. Dr.Luis Augusto Colembergue from Gerdau Special Steels, Brazil gave the presentation on recent developments in Automotive Steel and Special Bar Quality Steel. The main focus of the presentation was Gerdau´s view of the technological trends in special steels

Dr.Luis Augusto Colembergue during his presentation on recent developments in Automotive Steel and Special Bar Quality Steel.

for automotive applications. Recent lines of product developments for the different automotive systems were shown, along with some of non-automotive applications. He also discussed in depth the Threats for steel in auto applications.

Design with Powders –

A technical presentation on Design with Powders was presented by Dr.Sundar V.Atre, (tenured faculty at the Oregon State University's School of Mechanical, Industrial and Manufacturing Engineering) which was held on 24th November 2014 by ASM Pune Chapter. Presentation was based on the research of design and manufacturing of multi-scale architectures using ceramic and metal powders. The design principles were extended to a broad range of products in areas including tooling for injection molding, high temperature ceramic engines, power electronic solid state lighting packaging, armor portable kidney dialysis and micro systems.



Dr.Sundar V.Atre giving his presentation on Design with Powders .

Modern Approach to the Quality Control of HT Processes Based on CQI-9 Requirements –

ASM International Pune Chapter & Super Systems Inc., USA organized a technical

presentation on Modern Approach to the Quality Control of HT Processes based on CQI-9 requirements on the 28th January 2015. Dr.Damian Bratcher, Director International Operations – Super Systems Inc., gave the presentation.

Dr.Bratcher spoke at length on atmosphere control, automation and optimization by focusing upon sensor, instrumentation, analyzer and software technologies and how these elements interact with current specifications (ISO, CQI-9, NADCAP, AMS2750D, AMS2759, etc.). He also spoke on software solutions available for documentation, optimization and process automation. The presentation was well received by 93 participants from various fields of engineering. Required information is accessible on the link

http://ftp.supersystems.com/fileshare/SlideshowWithLinks.rar

Dr. Damian Bratcher's presentation.

A section of the audience

Know Our Members

Ms. Jaswandi Gotmare is currently working with Climate Technology's Material Research Centre, at Emerson Innovation Center-Pune. She holds a Bachelor's degree in Metallurgical Engineering and Master's Degree in Process Metallurgy from Govt. College of Engineering (COEP), Pune.

She is having rich functional experience, of around 18yrs, in various functions which include Cast Iron Foundry, Stainless Steel Foundry, Fasteners and Supplier Quality. Prior to joining Emerson she has worked in organisations like General Motors, Caparo Fasteners etc. Major part of her experience is with foundry, casting simulation, metallurgical quality control and RnD. She has got hands on experience in casting simulation and also worked as freelance consultant to foundries by providing casting simulation services.

After joining Emerson she got the opportunity to establish material research laboratory and has the responsibility to take it to next level as Material Center of Excellence. Along with the regular responsibilities, additionally she is working in publication team of climate technology's quarterly technical magazine.

During her carrier she has undergone many specialised technical as well as managerial training programs like Supervisory Effectiveness , Speaking with Impact, Casting Simulation, Special Process Audits like CQI9, Control Plan Audits, GM QSB, Potential Supplier Assessment and Red X Journeyman.

Her hobbies are reading and trekking.

Technical Article on Carburizing Atmospheres

- by Dattatreya Laxman Joshi

The carburizing atmosphere surrounds the work pieces with an atmosphere of determinable carbon activity. It is essential to accurately measure and to control the carbon activity to get the desired case properties.

The carburizing gas also performs an incidental, yet important function of excluding air from the quenching chambers of furnaces having integral quench tanks Viz. SQF and Pusher carburizers. Sufficiently high rate of flow of atmosphere gas has to be maintained to avoid accumulation of explosive air-gas mixture in the quenching chamber.

Heat treatment shops, earlier, used pit (sealed retort) furnaces and were happy with the results they obtained. Some of these acquired sealed quench (Integral Quench) or continuous carburizers, which offered mechanized handling of loads and process automation. However the SQfs' used higher flow rates of atmosphere gas. It was not convenient and economical to provide such large volumes of methanol. The Endothermic gas generators and the Nitrogen-Methanol systems were found suitable.

The Carbon Potential (Cp) is a function of three variables, 1. Temperature (measured by thermocouple) 2. Oxygen content (usually measured by O2 Probe) 3. Carbon Monoxide content, CO%.

In most of the Cp control systems the first two variables Viz. Temperature and O2 content are continuously measured and used to calculate the Cp. The third variable is presumed to be constant and is given to the controllers as a predetermined input. The accuracy of the Cp control system therefore is dependent on providing an atmosphere gas with stable and known carbon monoxide content. Most of the atmosphere systems therefore rely on a carrier fluid in order to provide a stable carbon monoxide level and a small proportion of enrichment fluid to attain the desired Cp. It is sometimes necessary to feed dilution air to reduce the Cp.

The often used combinations are

Sr	carrier	enrichment	Reaction	Carbon Monoxide %
1	Methanol	acetone, Iso-propyl Alcohol, L.P.Gas	CH3OH=>CO + 2H2	(1.7* CH3 OH/3)*100 = 33.66%
2	Methanol + Nitrogen	L.P.Gas	CH3OH=>CO + 2H2	(1.7* CH3OH/3)/(1.7* CH3OH +N2)*100
3	Endothermic gas	L.P.Gas	C3H8 + 6N2 + 1.5O2 + HEAT => 3CO + 4H2 + 6N2 2CO + O2 => 2CO2 CO + H2O => CO2 + H2	3/((6+Ex*0.8)+7)
	Symbols	CH3OH	Methanol flow (ltrs/Hr)	
		N2	Nitrogen flow (Cu.Mtr./Hr)	
		C3H8	Propane flow (Cu.Mtr./Hr)	
		Air	air flow rate (Cu.Mtr./Hr)	
		Ex.	Excess air= Air-7.5C3H8	
	Note		for endo gas only dilution effect due to excess air is considered	

1. Methanol with either Acetone or IPA is being commonly used in pit type carburizing furnaces. This type of furnace has an alloy steel retort and a retort head which is firmly secured to the retort. Therefore a small methanol flow is adequate to maintain pressure during the process .Some heat treatment plants use methanol and L.P.Gas atmosphere successfully in sealed quench furnaces of the in-out design. These furnaces are required to have an air tight purge chamber and a separate rapid inert gas filling system for the purge chamber. The advantage of this atmosphere is that the carbon monoxide percentage remains constant irrespective of changes in the flow rate. It is therefore the most easy to manage carburizing atmosphere.

2. Methanol and Nitrogen mixture is used mainly in sealed quench furnaces. It is also being used successfully in pusher carburizers. The carbon monoxide content in this type of atmosphere can vary widely due to fluctuations in the flow rates of any of the two components. This can affect the evaluation of Cp and the carburizing process can go wrong. These furnaces usually have glass tube rotameters to measure the flows. These have been found to be inaccurate and susceptible to errors due to tubes getting dirty as well as foreign particles sticking to the floats. It is advisable to periodically verify accuracy of the Methanol flow meters. One should monitor the carbon monoxide content if the facility is available. If properly executed this can be used as a stand by to continue production during endo-gas outages.

3. Endothermic gas and L.P.Gas atmosphere is the most common choice for sealed quench and pusher carburizers. It was the cheapest process to generate large flow rates of atmosphere gas for many years due to low price of L.P.Gas. Flow rates of up to 5 times the furnace chamber volume were used to maintain pressure and to quickly fill the purge chamber after a load, unload or quench operation. The contents of the endothermic gas are affected by the air-Gas ratio, effectiveness of the “after cooler”, temperature of the retort and the catalyst condition.

   Various designs of endo gas generators are in use. One design which used a carburetor for maintaining the air-gas ratio over wide range of endo-gas throughput is popular. Another one which uses dew point measurement to automatically control the reaction gas flow is more reliable. However generators which depend on manual flow control are difficult to manage. One must be aware that the endo generators have inertial response to changes in flow rates. Leaning or enriching of the reaction gas produces a response after some time. The product quality may be affected during such incidents. If the reaction gas mixture is not right the carbon monoxide content will vary, affecting the Cp evaluation.

The availability of modern instrumentation and flow control devices has created an opportunity for reducing the required flow rate of atmosphere gas, which has following advantages.

1. Substantial saving in the cost of atmosphere gas.

2. The saving in heat which is consumed for heating up the atmosphere gas to furnace temperature.

3. Less soot formation in the hot chamber and the purge chamber. Loss of time due to burn outs is minimized.

The specifications listed below, demand strict control on the properties of carburized case. It would be possible to meet these specifications only if precise control on the carbon potential is exercised.

1. 50% of the case must have hardness more than specified Rockwell C hardness

2. Appearance of Bainite, that is within certain depth from surface is not allowed

3. The carbon gradient in production parts must not have a carbon level near the surface less than the peak value at some greater depth.

Comparison of operating Cost for atmospheres 30Cu.Mtr/Hr Generator , four SQF furnaces

Endo-gas				**Nitrogen-Methanol**				**Methanol (In-Out furnace with sealed chamber)**		
	Cu.Mtr/Hr	Cu.Mtr./Hr.			Cu.Mtr./Hr.	Ltr./Hr			Cu.Mtr./Hr.	Ltr./Hr
Heating LPG	1.14	1.14		Methanol	20.4	12.00		Methanol	9.52	5.60
reaction LPG	1.875	1.88		Nitrogen	9.6	9.6		Nitrogen	0.5	0.5
Endo-gas Flow total	**30**				**30**				**14**	
LPG Consumption Cu.Mtr/Hr		3.01		Methanol Consumption, Ltrs/Hr.		12.00		Methanol Consumption, Ltrs/Hr.		5.60
LPG. Consumption Kg./Day		159.00		Methanol Consumption, Ltrs/Day		288.00		Methanol Consumption, Ltrs/Day		134.40
				Methanol Cost/Day		5472.00		Methanol Cost/Day		2553.60
				Nitrogen Consumption Cu.Mtr/Day		230.4		Nitrogen Consumption Cu.Mtr/Day		12
				Nitrogen Cost/Day		2073.6		Nitrogen Cost/Day		96
Running Cost/Day		9858		Running Cost/Day		7545.60		Running Cost/Day		2649.60
Electricity for blower and mixer pump, 5Kw/Hr		990								
Total Cost		10848				7545.60				2649.60
				Saving on operating cost/Day		3302.40		Saving on operating cost/Day		8198.40
				Saving on operating cost/Month RS.		99072.00		**Saving on operating cost/Month RS.**		245952.00

4. Content retained austenite shall not exceed 10-30 percent in the as-heat treated condition
5. Continuous or intermittent grain boundary network carbides are not permitted.

The comparison above is only for the cost of consumables. The Endo Gas Generator involves more expenses for Maintenance such as replacement of retorts, repairs of pumps, catalyst replacement etc. these expenses are virtually absent in case of the Methanol/ Nitrogen-methanol atmosphere. There is an opportunity to reduce the cost further by turning down gas flows between loadings. The system can start instantaneously unlike the endo generator which needs time to heat up and to achieve the required carbon potential. Gas is wasted for every shut down and restarts. If these costs are considered the savings are more. Besides there are quality advantages due to more stable operation. The atmosphere gas produced by mixing Nitrogen-Methanol in the right proportion can have the same composition as Endo-Gas.

ABOUT THE AUTHOR

DATTATREYA LAXMAN JOSHI

Dattatreya Laxman Joshi is a graduate in metallurgical engineering from Indian Institute of Technology Mumbai. He was president of the Heat treatment business at Unitherm Engineers Ltd. Joined Bodycote Metallurgical Services as Business Development Manager. At present working as Head of Metallurgy and Customer Support at M/SRIJ Engineers Pvt. Ltd.

He has been setting up new heat treatment capacities and making these technically and commercially successful for many years. He may be contacted via E-Mail : dattatreya.joshi@gmail.com.

OBITUARY

Mr. Max Babi

We regret to inform the sad demise of Mr.Max Babi on 15th March 2015. Mr.Max Babi has been associated with ASM Pune Chapter. He was a distinguished speaker on ASM forums and has contributed to ASM Newsletters. We at ASM Pune Chapter will miss him greatly.

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