The University of the Witwatersrand presents

SHORT COURSES IN

COAL, COKE AND CARBON IN THE METALLURGICAL INDUSTRY

INTRODUCTION TO COAL, COKE, CHAR, ANTHRACITE AND RELATED CARBON MATERIALSANF THEIR USE
QUALITIES, PROPERTIES, PREDICTIONS, PRODUCTION AND INDUSTRY REQUIREMENTS

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Five-day course
Daily attendance or

8-12 June 2009

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Module in the
Postgraduate Programme for Industrial Personnel

LEADERSHIP IN FUEL & ENERGY TECHNOLOGY

Hosted by
School of Chemical and Metallurgical Engineering,
University of the Witwatersrand

Venue:
Wits Sports Administration Building, Sturrock Park Campus,
University of the Witwatersrand

Co-Convenors:
Prof Rosemary Falcon, *University of Witwatersrand*
Prof Hurman Eric, *University of Witwatersrand*
Dr Ricky Pinheiro, *Petmin Limited*

OBJECTIVES OF THE COURSE

The purpose of this course, therefore, is to present

- Introduction to the metallurgical ores, extractive processes and pyrometallurgical technologies involved
- Outline of the roles of coal, coke and carbon materials in each of the industries
- Definitions and descriptions of the carbon materials available; their analyses, tests and property prediction mechanisms
- Case histories and use in the various industries, and finally
- The long term view of the carbon reductant issue and how this may evolve in the future.

OUTLINE OF THE COURSE:

Topics include the following:

- ***Introduction to pyrometallurgical processes*** in iron, steel and ferroalloy production with thermodynamics and phase-equilibria
- ***Introduction to the raw ores***: Iron ore, steel, base metals and ferroalloys
- ***Principal equipment*** and methodologies
- ***Role of coal and carbon*** in different metallurgical processes
- ***Carbon reductants:*** their sources, manufacture and characteristics – coke, char, anthracite, pulverised coal (pci)
- ***Key properties:*** testing and predictive mechanisms for coking coals and their resultant cokes – carbon reactivity, resistivity, strength, porosity; structure and texture; chemical reaction kinetics
- ***Trends and innovations in metallurgical processes*** in relation to future carbon feedstocks
- ***Delayed coking and calcining –*** chemistry, industrial production and associated value added markets for gasification pitch cokes
- ***Advanced carbons -*** advanced value-added forms of carbon including activated carbon, carbon fibres, isostatic pressed graphites and carbon-carbon composites
- ***Petroleum coke –*** production / future quality vs. supply parameters and the affect on the Aluminium industry
- ***Economics and the future of coal*** as source of carbon in the metallurgical industry

BACKGROUND

Prior to 1975, coal mining and marketing practices were uncomplicated, being largely influenced by the abundance of good quality raw coals. In many cases, the best parts of seams were mined out to meet market specifications and requirements for all including the direct reduction market in the metallurgical industry. From the 1950s, this included specific products mined in the Kwa Zulu Natal region as prime coking coals for Iscor, South Africa's largest Iron and Steel Corporation (now split into Kumba Iron Ore, Exxaro and Arcelor Mittal South Africa).

Subsequently, as the Natal coking coal resources began to dwindle, coals from basins in the then-Northern Transvaal (Limpopo Province - Tshikondeni and North-West Province - the Waterberg) began to be exploited, but the properties of these coals did not in all cases match up to prime coking coals of Natal. And thus began in earnest the complicated process of blending of a number of non- or semi-coking coals with prime coking coals which then had to be imported from abroad.

The costs of manufacturing coke began to rise and shortages were encountered as the metallurgical industry began to expand following the exploitation and local processing of the chrome, vanadium, silicon, manganese, and later platinum and related industries.

Alternative carbon products were sought to fill the reductant shortages and thus began the early char-making industry in the 1980s, this for specific processes and the ferrochrome industry in particular. In parallel to this was the development of the anthracite industry, but South Africa has long passed the peak of local production in that industry, and the country now imports most of its prime metallurgical anthracite from abroad, with some notable exceptions that have developed in recent times.

New products are continually entering the market, and these are being tested against conventional products in the wide array of iron, steel, base metal and ferroalloy industries now flourishing in this country. However, the future of coal as a carbon reductant and electrode filler for the vast quantities of iron ore and base metals in this country remains of serious concern.

WHO SHOULD ATTEND THIS COURSE

- Geologists
- Mineral (coal) resource managers
- Coal processing engineers
- Marketing and trading personnel
- Iron and steel, and ferroalloy personnel and users of coal
- Fuel technologists
- Financial funding agencies
- Government and company policy planners
- Researchers and lecturers in academia.

COURSE PROGRAMME

DAY 1 – MONDAY 8 JUNE

INTRODUCTION TO PRINCIPLES, PROCESSES, ORES AND REDUCTANTS

- **Introduction** to pyrometallurgical processes in iron, steel and ferroalloy production in South Africa. Brief history of iron and steel processes, and changes in technology; future prospects, importance to the SA economy.
- **Principle equipment and methodologies**. Introduction to the raw ores: Iron, steel and ferrometal ores.
- **Key reactions** in the pyrometallurgical processes: thermodynamics and phase equilibria.
- **The Role of Carbon** and key reactions in the pyrometallurgical processes:

Prof Rauf H Eric – University of the Witwatersrand
Dr Lourens Erasmus – Agglomeration Alternatives International

DAY 2 – TUESDAY 9 JUNE

COAL, COKE AND CARBON: PROPERTIES, QUALITIES, FORMATION, TESTING AND PREDICTION

- **Origin, formation, constitution and nature of coal and carbon reductants**: coal, coke, char and anthracite
- **Coke** – specifications for coking coal, coal sources, key properties of coke, principles of coke-making. Methods of testing and evaluation; prediction models and principles of blending for optimum coke quality
- **Char** - coal source requirements, analyses and principles of char-making.
- **Anthracites** – sources, key properties, market requirements and principles of utilisation.
- **Gasification pitch cokes -** delayed coking and calcining, chemistry, industrial production for gasification pitch cokes

Prof. Rosemary Falcon – University of the Witwatersrand
Mr John Clark - Sasol Synfuels Marketing
Dr Ricky Pinheiro – Petmin Limited

DAY 3 – WEDNESDAY 10 JUNE

ADVANCED COAL AND CARBON MATERIALS

- **Delayed coke** - associated value added markets for gasification pitch cokes
- **Petroleum coke** – production and future quality versus supply parameters and the affect on the Aluminium industry; local and world trends
- **Advanced carbons** - advanced value added forms of carbon including activated carbon , carbon fibres, isostatic pressed graphites and carbon-carbon composites
- **Needle Coke** and new innovations (new lecture)

Mr John Clark - Sasol Synfuels Marketing

DAY 4 – THURSDAY 11 JUNE

CASE STUDIES AND THE FUTURE

- **Case studies** – pyrometallurgical processes and plant operations
  - Metallurgical uses of coal and coke in iron and steel processes
  - Evaluation of blend coking coal (including semi-soft coking coal)
  - Experiences in the ferroalloy and related industries industry
- **Marketing** importing of high quality anthracites; anthracite export markets
- **Overview** of the requirements to meet future metallurgical industry needs.
- Closing discussion and syndicated project allocations.

Mr Hans Erasmus – Consultant – CNI Technologies
Mr Stuart Goddard – Resource Energy Engineering Fuels
Dr Ricky Pinheiro – Petmin Limited

DAY 5 – FRIDAY 12 JUNE

Visit to Xstrata Carbon Division (Ferrobank), which operations include char production and manufacture of soderberg electrode paste.

COAL, COKE AND CARBON IN THE METALLURGICAL INDUSTRY

REGISTRATION - FIVE-DAY ATTENDANCE:

R6 500-00 + VAT R910.00 = R7 410-00

Email registration to: MRS L STEPHENSON. VAT No: 4270185251
Tel/Fax: 011 447 1490 Cell: 083 679 0697 Email: lstephenson@mweb.co.za

NAME:……**TITLE**……..

AFFILIATION ……

COMPANY…… ……

ADDRESS……

TEL:……**FAX**…… ……..

MOBILE……..**EMAIL:**……

ACCOUNTS CONTACT PERSON……

ACCOUNTS TEL NUMBER……

ACCOUNTS EMAIL ADDRESS……

COMPANY VAT NO…….. **VENDOR NO**…….. **PURCHASE ORDER NO**:……..

NB: ATTENDANCE IS STRICTLY SUBJECT TO PAYMENT PRIOR TO THE COURSE

BANKING DETAILS: ***Please fax a copy of the deposit slip or EFT to (011) 447 6148 or email projects@fossilfuel.co.za.***

Fossil Fuel Foundation of Africa (Education)
Bank: ABSA
Branch Code: 632 005
Account No: 919 978 4837
Ref: PLEASE USE YOUR INVOICE NUMBER AS A REFERENCE ON THE DEPOSIT SLIP OR EFT.

CANCELLATION OF THIS REGISTRATION

Cancellation may be made in writing 7 days prior to this course, whereon a 25% cancellation fee will be charged. No refund or credit will be issued within the 7 days of the course. Registrations are transferable. Invoices will be sent once registration forms have been submitted.

KINDLY NOTE: ATTENDANCE IS STRICTLY SUBJECT TO PRIOR PAYMENT

COAL, COKE AND CARBON IN THE METALLURGICAL INDUSTRY

REGISTRATION - DAILY ATTENDANCE:

R1 500-00 + VAT R210.00 = R1 710-00 per day

DAY 1……. DAY 2…….. DAY 3…….. DAY 4……..… DAY 5…….

Email registration to: MRS L STEPHENSON. VAT No: 4270185251
Tel/Fax: 011 447 1490 Cell: 083 679 0697 Email: lstephenson@mweb.co.za

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ACCOUNTS EMAIL ADDRESS……

FFF MEMBERSHIP ….Yes/No…….. No……..

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REMAINING COURSE PROGRAMME FOR 2009

COAL SCHOOLS:

- **3- Coal Preparation and Beneficiation:** 3-7 August 2009
- **4- Coal Conversion:** 31 August – 4 September 2009
- 5- **Coal Combustion, Power Generation and CCT**: 9-13 November 2009

NB: Courses are subject to cancellation or date changes.

Please check via "Technical enquiries" margaret.blair@wits.ac.za or in relevant Schools in the University)
or via Mrs Lesley Stephenson ***Cell: 083 679 0697*** ***Email: lstephenson@mweb.co.za***