WEDNESDAY, AUGUST 25, 2004, A.M.

SESSION 41: SECOND INTERNATIONAL SYMPOSIUM ON GREENHOUSE GASES IN THE METALLURGICAL INDUSTRIES: POLICIES, ABATEMENT AND TREATMENT

Sponsors: Environment Committee, The Metallurgical Society of CIM, the Environmental Society of CIM, the Non-Ferrous Pyrometallurgy, the Iron and Steel Section, The Metallurgical Society of CIM and CANMET
Room: 206
Chairman: C.A. PICKLES, Department of Mining Engineering, Queen's University, Kingston, Ontario, Canada

PAPER 41.1 — 8:30
GLOBAL WARMING - REALITY OR CONJECTURE?
J. STUBBLES, Steel Industry Consultant, Mason, Ohio, U.S.A.

Data are presented on the global warming issue to reinforce the decision by the U.S to reject the Kyoto protocol. The evidence that CO2 is a problem rather than a benefit is inconclusive and will be discussed in this paper. Nevertheless, for economic reasons alone, the US steel industry will continue to minimize CO2 emissions (and the release of real pollutants) per ton of steel through energy reduction programs. However, relative to inevitable increases in absolute CO2 emissions from the utility industry and the transportation sector, future reductions by the steel industry will be inconsequential in the "big picture."

PAPER 41.2 — 8:55
GREENHOUSE GAS REDUCTION EFFORTS IN THE CURRENT REGULATORY ENVIRONMENT.
M. SIMPSON, Iron Ore Company of Canada, and
J. FARRELL, Hatch Energy Consulting, Mississauga, Ontario, Canada

The Canadian government ratified the Kyoto Protocol in December 2002 and, prior to ratification, committed to equitable distribution of the burden of implementation. The Federal government's Large Final Emitters group is working with industry to develop covenants that will consider the unique nature of the company's operations and not unreasonably burden any one sector or company. Ensuring equitable distribution must consider local, national and international issues. From a Canadian iron ore producers perspective, the fact that most of the iron ore production in the world is in countries that have no Kyoto commitment is a critical issue. Another issue unique to this sector is the increased addition of fluxing agents in iron ore pellet production which has shifted some process related greenhouse gas emissions from steel producers to iron ore producers. While the objectives of the Kyoto Protocol are primarily environmental, the economic implications for Canadian industry are not trivial. The paper will highlight the unique issues faced by Canadian iron ore producers, IOCC's comprehensive and systematic approach to energy management and how the current regulatory environment influences its efforts to improve energy efficiency and reduce greenhouse gas emissions.

PAPER 41.3 — 9:20
MITIGATING CARBON DIOXIDE EMISSIONS AND ULTRA-LOW CARBON DIOXIDE STEELMAKING.
J.-P. BIRAT, ARCELOR,

Steel lies at the core of modern society in developed countries and will continue to play this role long into the 21st century. Steel is a mature basic material and the production technology has reached very high levels of efficiency. This dichotomy sets the stage for the challenge that the steel industry faces in the short term of reducing carbon dioxide emissions when significant reductions are not possible because of the high efficiencies which have been achieved by many producers. In the long term the development of alternative new process routes could drastically reduce the carbon dioxide emissions. In Europe an organization named ULCOS (Ultra-Low Carbon Dioxide Steelmaking) has been established in order to study alternative steelmaking processes and to develop the most promising one.

PAPER 41.4 — 9:45
A NOVEL IRON-MAKING TECHNOLOGY OF SMELT REDUCTION COMBINED WITH CLEAN FUEL MANUFACTURE.
Z.L. WANG, Department of Chemical Engineering, Univeristy of Leeds, Leeds, United Kingdom,
J.F. WANG and Y. JIN, Tsinghua University, Beijing, China

Smelting reduction as a major iron-making technology for the 21st century has been challenging the traditional blast furnace. The process have many attractive advantages over the blast furnace, however, the massive by-produced coal gas mainly containing CO, H2 and CO2 should be further treated. From the chemical engineering point of view, coal gas is a valuable chemical stock and can be transformed into hydrogen-rich synthesis gas. Hydrogen can be directly used as clean fuel and synthesis gas can be used for the production of some important chemicals such as methanol, ammonia and dimethyl ether. Among those chemicals, dimethyl ether is an alternative clean fuel for diesel engines and liquefied petroleum gas has been drawing more attention. It has excellent environmentally-benign behaviours not only in compression ignition combustion, but also in the much lower emissions of SOx and NOx. In this work, a combined technology of smelt reduction iron-making and direct synthesis of dimethyl ether, which will strongly promote energy efficiency, environmental protection and resource recovery, is proposed and described in detail.

COFFEE BREAK — 10:10 – 10:30

PAPER 41.5 — 10:30

INCREASE OF EFFICIENCY AND DECREASE OF POWER CONSUMPTION IN SO2 RECYCLING FROM OFF-GAS OF PYROMETALLURGICAL PROCESSES.

V. BALDIN, Ural State Technical University, Ekaterinburg, Russia,
Y. GORDON, Hatch, Mississauga, Ontario, Canada, and
Y. YAROSHENKO, Ural State Technical University, Ekaterinburg, Russia

Manufacturing of sulphuric acid from the off-gas of pyrometallurgical processes in the production of heavy metals is one of the common methods of effective recycling of sulphur dioxide. The new Impact-Inertial Devices with rectangular contact channels (IIRCh) and internal circulation of liquid allow the injection of an absorber into the phase's interactive cell by utilizing gas stream energy and by this way increases the sulphuric acid yield and reduces the power consumption. These devices have the following advantages: simplicity of design, smaller size, low capital expenses, absence of irrigating system, high operational reliability, simultaneous cleaning from solid, gaseous and liquid impurities and also cooling of gases etc

PAPER 41.6 — 10:55

ENVIRONMENTAL BENEFITS DERIVING FROM THE APPLICATION OF POST-CONSUMER GLASS AS A CEMENTING AGENT IN MINE BACKFILL.

E.M. DE SOUZA and J.F. ARCHIBALD, Queen's University, Kingston, Ontario, Canada

Many Canadian underground mines use backfill to mitigate environmental effects associated with tailings disposal. Backfill production and disposal are energy intensive processes that require an average energy cost of 37.7 MJ/tonne of backfill to complete. Mine backfills, in engineering applications, also commonly make use of cement as a stabilizing agent. Cement requires an additional energy cost ranging between 4,637 and 6,600 MJ/tonne to produce. The large energy needs associated with mine backfilling and cement production operations create significant CO2 and greenhouse gas emissions. Approximately 1 tonne of CO2 and greenhouse gas is emitted for each tonne of Normal Portland Cement produced. For single mines producing 3,000 tonnes of backfill per day, considering both backfill and cement emission source terms, total emissions of CO2 ranging between 120.36 tonnes and 169.44 tonnes/day are anticipated. In Ontario, mining operations contribute 700,000 - 840,000 tonnes/year of CO2 and greenhouse gas emissions to satisfy backfill cement consumption needs alone. This paper examines aspects of Canadian mine backfilling operations that may be implemented to assist in reducing solid waste production, lowering energy costs, and restricting greenhouse gas emissions.

PAPER 41.7 — 11:20

INCREASE IN EFFICIENCY OF NOX REDUCTION DURING SIMULTANEOUS APPLICATION OF PRIMARY METHODS.

L. SZECOWKA, J. SIWKA and M. POSKART, Czestochowa University of Technology, Czestochowa, Armii Krajowej, Poland

Oxides of nitrogen, created during combustion, are the most hazardous components of atmospheric pollution. However, it is possible to limit the negative influence of hazardous components on the natural environment. An experimental system was built to determine the influence of the following "primary methods" on the reduction in concentration of NOx: air staging, reburning and flue gas recirculation. The influence of simultaneous usage of the primary methods on reduction in NOx emissions was also examined. Noticeably an increase in the efficiency of NOx reduction was achieved in two cases.

PAPER 41.8 — 11:45

ADVANCED DIELECTRIC CERAMICS APPLIED IN HYDROGEN GENERATION SYSTEMS.

R. VINTILA, G. MENDOZA-SUAREZ, J.A. KOZINSKI and R.A.L. DREW, McGill University, Montréal, Québec, Canada

Economics and environmental considerations along with the increasing demand of hydrogen encourage development of novel technologies, such as plasma processing of hydrocarbons and thermal cracking of natural gas. Plasma discharges, either in thermal or non-thermal regimes are expected to allow low temperature and fuel flexible on-site hydrogen generation. The main drawback of thermal plasma reformers is the high-energy consumption resulting from high-temperature operation. On the other hand, non-thermal plasma generated by dielectric barrier discharge (DBD) is able to simulate the chemical reactions employing an amount of energy much lower than the energy required by thermal treatment processes. The focus of this research is on the GHG-free method of H2 generation in compact non-thermal plasma reactors using low, medium and high permittivity ceramic dielectrics.