MONDAY, AUGUST 23, 2004, P.M.

SESSION 11: FIFTH INTERNATIONAL SYMPOSIUM ON WASTE PROCESSING AND RECYCLING IN MINERAL AND METALLURGICAL INDUSTRIES

IRON AND STEEL
Sponsors: Hydrometallurgy, Non-Ferrous Pyrometallurgy, Iron and Steel Sections and Environment Committee of the Metallurgical Society of CIM and the Environmental Society of CIM
Room: Chedoke B
Chairmen: M.P. SUDBURY, Environment Consultant, Toronto, Ontario, Canada, and
F.W. HARRISON, Stelco, Hamilton, Ontario, Canada

WELCOME AND INTRODUCTION — 14:00

PAPER 11.1 — 14:05 (KEYNOTE)
TOWARDS ZERO WASTE.
D. CONOCHIE, McMaster University, Hamilton, Ontario, Canada

The world is poised for rapid growth in consumption as large, less developed economies acquire greater wealth. It might be expected that there would be a corresponding growth in waste generation, but this might not necessarily be the case. The metallurgical industry has an excellent record of process development which has allowed it to provide a high tonnage supply of low cost, high quality metals. Environmental challenges have been faced and indeed the recycling of scrap iron through the electric arc furnace has made a massive contribution to cleaning up obsolete structures and equipment of past generations. Issues in waste generation and processing still remain, and the expectation for cleaner processing and environmental performance continues to rise. The waste impact of key process developments of the last century and the recent developments in metallurgical waste processing in Canada will be outlined. The potential to use state of the art design tools to produce the next generation of zero waste processes will then be explored.

PAPER 11.2 — 14:50
USE OF OXY-FUEL BASED IN-PLANT RECYCLING OF DUST AND SLUDGE.
J. VON SCHÉELE, Market Development Metallurgy, Linde, Lidingö, Sweden

An oxy-fuel based technology – OXYFINES – has been introduced for in-plant recycling. It provides fines, dust, sludge (without any drying-step) and other by-products arising in the steel and metal producing industries to be recycled directly back into existing processes or a separate unit on-site. Results from full-scale installation (20,000 tpy) for dust treatment, full-scale and pilot-scale trials with dry and wet materials in the steel and ferroalloy industries are presented. Processing rates at 3.5 t/h have been demonstrated. The product is agglomerates or lumpy pieces, the latter if the product has passed an all-liquid stage and thereafter been crushed. The technology does not only provide a solution to the problems connected to dust and sludge generated in metal production. It also turns these materials into a low-cost raw material useful for the production in question, thus replacing part of the raw material input in electric arc furnaces, blast furnaces, etc. Elements harmful to re-use of the processed dust or sludge, e.g., zinc and alkaline components in steel production, are removed as secondary dust, and material yield of main components for re-use is very high, about 98%. The paper reviews the concept, the results obtained and its status; its use for sludge recycling is emphasized.

COFFEE BREAK — 15:15 -15:40

PAPER 11.3 — 15:40
CHARACTERISATION OF PROCESSED BLAST FURNACE AND STEEL-MAKING CONVERTER DUST.
M. GOYAL, D.S. SARMA, Banares Hindu University, Varanasi, India,
J. VON SCHÉELE, Market Development Metallurgy, Linde, Lidingö, Sweden, and
P.G. JÖNSSON, Royal Institute of Technology, Stockholm, Sweden

Dust from flue gas cleaning systems at iron and steel production is frequently considered as a waste problem, but it is actually a potential raw material source. By using a technology like the oxy-fuel based Oxyfines technique, it can be melted into a suitable form. The product from this processing, however, needs to meet the requirements of a recyclable raw material, as a top-charged blast furnace feed. The present work has been focused on characterization of the product from these dusts by Oxyfines technology. The investigation has been carried out on samples of processed dusts from a European integrated steel mill. Special attention was paid to the presence of zinc, an element that might be harmful while recycling the material (e.g., in a blast furnace). The results show that the product contains four different regions with different morphologies and properties in the material, which are discussed in detail. The overall

conclusion is that by processing the dusts in this way, a raw material suitable for recycling in a blast furnace can be obtained.

PAPER 11.4 — 16:05

ZERO WASTE STEELWORKS – VALUABLE PRODUCTS FROM BY-PRODUCTS.

A. FLEISCHANDERL, W. GEBERT, U. GENNARI, VOEST-ALPINE, Industrieanlagenbau GmbH & Co., Linz, Austria
J. BORLEE, Centre de Recherche Metallurgique, Liege, Belgium
F. SORRENTINO and M. GIMENEZ, Lafarge Research Laboratory, Isle d'Abreu, France.

Large quantities of solid by-products are generated by the steel industry and other important activity sectors in Europe (power plants, car dismantling companies, urban incinerators) with no or very limited potential for direct recovery. In the frame of a multi-national project supported by the European Union, a consortium has been created to develop a treatment process able to turn these by-products into valuable metallic and mineral products.

VAI has been responsible for the design, erection and start-up of the pilot plant for the new metallurgical process and for the execution of the test campaigns, with the targets defined together with the partners. Up to now, 9 campaigns comprising 60 heats have been performed successfully. By-products from C-Steel and stainless steel plants, as well as fly ash and auto shredder residues, have been used and defined products such as hydraulic binders for cement, metallurgical powders for De-S practice and recycled metal phase have been produced.

The mineral products were positively assessed under industrial conditions. Results from cement tests and secondary metallurgy are reported, as well as a detailed characterization. The economic value of the products, credits from avoiding dumping and significant savings on CO_2 emissions make the new process economically very attractive.

PAPER 11.5 — 16:30

THE USE OF WASTE MATERIALS FROM ALUMINUM PRODUCTION AS REFINING FLUXES FOR HOT METAL AND LIQUID STEEL.

Y-D. YANG, I.D. SOMMERVILLE, A. MCLEAN, University of Toronto, Toronto, Ontario, Canada,
X. BI, Wuhan University of Science and Technology, Hubei, China, and
J. HOU, Shandong Aluminum Company Ltd., Shangdong, China

Waste slag is a major environmental concern within the metallurgical industry. In the steel industry, about 100 kg of slag is produced in making one tonne of liquid steel from iron in addition to that produced during ironmaking. The amount of slag from the steelmaking converter can be significantly reduced when charging hot metal with low phosphorus and sulphur contents. In this context, hot metal pretreatment is known as an effective means of preparing high quality charge material for the converter thus limiting the generation of residual slag during the steelmaking process. In the aluminum industry, about 2-4 tonnes of slag, including red mud from alumina production and dross from aluminum electrolysis and casting, are generated during the production of one tonne of aluminum. In recent years, reuse of waste slag from the aluminum industry is a topic that is receiving increasing attention.

In this paper, the possibilities of using waste slag and by-products from the aluminum industry as a refining flux in the steel industry are discussed. Several successful processes to convert waste materials from the aluminum industry to steel refining fluxes are described. Some theoretical aspects of using calcium aluminate based flux for desulphurization are outlined together with results obtained from laboratory experiments on sulphur removal from hot metal. By intelligent use of waste materials, the disposal of solid waste from the metallurgical industries can be reduced.

PAPER 11.6 — 16:55

APPLICATION OF A WATERLESS, NON-CONSUMABLE OXYGEN LANCE (BURNER) IN METAL RECYCLING.

Z. YUAN, F. MUCCIARDI, McGill University, Montréal, Québec, Canada,
A. SIEGMUND and B. BULNES, RSR Corporation, Indianapolis, Indiana, U.S.A.

With conventional heat pipe science as the starting point, a new heat transfer technology --- termed Thermopump technology, has been developed at McGill University and is now being tested at a number of industrial operations. This technology is of particular importance for transferring energy in high temperature / high heat flux environments where solutions based on current techniques are not available. One important application for this technology is in the metals recycling area wherein this technology has been used to make a waterless, non-consumable, high efficiency Thermopump oxygen lance. The viability and efficiency of this oxygen lance have been demonstrated by preliminary plant trials in a reverb furnace for the recycling of lead-acid batteries at the RSR Corporation. Full-scale commercial trials of the Thermopump oxygen lance are to be carried out in the coming months at the RSR Corporation. The results from these tests will be presented. In addition, some applications of the Thermopump technology for other metal recycling processes will also be discussed in this paper.