

Author Guide

Preparing a Technical Paper

for the
Association for
Iron & Steel Technology



Association for Iron & Steel Technology
186 Thorn Hill Road
Warrendale, PA 15086-7528
(724) 776-6040

Revised January 2008

Introduction

These guidelines have been developed to assist authors with the preparation and submission of their technical papers for Association for Iron & Steel Technology (AIST) conference proceedings. It is the goal of the AIST to advance the technical development, production, processing and application of iron and steel. To this end, it is important to achieve a high degree of quality and uniformity with published papers. AIST requires papers to be submitted electronically with full text and images.

Please read ALL instructions BEFORE preparing the paper.

Writing and Organizing the Paper

Authors must carefully proofread material before submitting papers for publication. Papers will be checked for adherence to formatting guidelines. Basic spelling and grammar will be checked *in the title only*. Papers must be in the proper format and be suitable for publication when submitted. Non-adherence to instructions will cause the paper to be returned to you for editing. Paper must be resubmitted in a timely manner to ensure publication. We recommend that non-English speaking authors have their work edited and proofread by someone fluent in English to ensure clear communication of the information in their paper.

Submission Deadline

Consult your session chairperson or the AIST Technical Program Coordinator for the publishing schedule for your paper deadline. Strict adherence to the deadline must be emphasized, otherwise AIST cannot guarantee publication.

Submission Requirements

Cover Letter

A letter of transmittal, with author(s) name(s), address(es), telephone, fax number and e-mail address *must accompany* each paper when submitted for publication. Indicate the name of the conference for which the paper is being submitted and the title of the session. Once submitted, manuscripts are the property of AIST and *will not* be returned. Authors are advised to make additional copies of their manuscripts for their own use prior to submission.

Copyright

A signed and completed copyright form must be submitted with the original manuscript. A written transfer of copyright is necessary under U.S. Copyright Law for AIST to grant permission to reprint from published volumes. However, the transfer of copyright from the author to AIST, as well as permission to publish, is implied in the act of submission of the manuscript.

Submission Method

AIST requires all papers to be submitted electronically with full text and images.

Electronic submissions will be accepted via e-mail; on 3.5 in. disk; CD-ROM; or Zip Disk. **Submissions must be in both Microsoft Word and pdf files.** Electronic copy must be clearly labeled with title of paper, author(s), conference title and session name.

PowerPoint presentations are not acceptable for publication.

It is not necessary to submit hard copy originals unless it is requested by AIST for clarification of information or images. See formatting instructions.

Guidelines for Writing the Paper

The following general outline should be used as a guide for organizing a paper:

Title
Author(s) Name(s) and Affiliation(s)
Key Words
Introduction
Text, Tables and Figures (inserted within text)
Summary (optional)
Acknowledgments
References
Appendices (optional)

Please see sample paper accompanying this guideline.

Title

The title should highlight the main theme of the paper and be as short and concise as possible.

Author(s) Name(s) and Affiliation(s)

List the author's full name (first name, middle initial, surname) and those of any co-authors. Do not use any courtesy titles other than Sr. or Jr. Also include name, address, phone and fax numbers and e-mail address of the company with whom the author and co-authors are affiliated.

Key Words

Key words will be used to develop a subject index. A list of six to eight key words that categorize the paper should be provided and placed centered on the page, immediately following the author(s) name(s) and affiliation(s) on the first page.

Introduction

The introduction should give a brief overview of any procedures, problems and conclusions presented in the paper.

Text, Tables and Figures

Editorial comments, commercialism or endorsements of any products are not acceptable. Use of company logos are not permitted. Tables and figures must be incorporated into the text where referenced and centered between text. Do not use text wrap or offset images. All information contained in the tables and figures must be written in English.

Summary

A summary is not essential; however, if one is included, it should briefly review the most significant information and conclusions of the paper. A well-written summary should be no more than one paragraph.

Acknowledgments

This section should be brief and written in the first person, using "I" or "we."

References

Please refer to “Formatting Instructions” for more comprehensive directions on how to create references. Formats and examples are cited in this section.

Appendices

An appendix is a listing of material (graphs, books, illustrations) related to the text, but not suitable to be included in it. Material in an appendix should be related to one topic, and each topic should form a separate appendix.

Page Numbers

Do not incorporate page numbers into electronic files. Pages should flow sequentially without page numbers marked.

Paragraphs

Do not indent text. It is not necessary to double-space between paragraphs, although it is preferred if you double-space between sections of the paper (see sample).

Formatting Instructions

Paper Length

The average length of a paper for AIST Conference Proceedings is **10 pages**. We would like to emphasize that your paper be kept between **8-12 pages**.

Page Dimensions and Margins

Manuscripts are to be electronically submitted with page setup at 8.5 x 11 in. (21.6 x 27.9 cm.). **Do not use A4 sizing in electronic files.** Please adhere to the following margins:

Top: On the first page, the title of the paper should begin 1.75 in. (4.45 cm.) from the top of the page. A 0.5 in. (1.27 cm.) margin should be used on the top of the following pages.

Left: 0.5 in. (1.27 cm.)

Right: 0.5 in. (1.27 cm.)

Bottom: 1 in. (2.54 cm.)

The text of the paper should be typed in one-column, single-spaced format, 10 pt. Times New Roman. Do not indent paragraphs.

First Page

Title—Using 12 point Times New Roman, bold, type the title in **capital and lower case letters** (not all caps), centered, using more than one line to complete the title if necessary.

Author(s) Full Name(s)—Using 10 point Times New Roman, center the author(s) full name two lines below the title, using capital and lower case letters.

Author(s) Affiliation(s)—Using 10 point Times New Roman, center the full name, address, phone and fax numbers and e-mail addresses of the author(s) name, using capital and lower case letters. If there are co-authors, repeat these instructions for each additional author.

Key Words—Using 10 point Times New Roman, list six to eight key words two lines below the author(s) name(s) and

affiliation(s), centered, using the heading *Key words*.

Introduction—Using 10 point Times New Roman, begin typing the introduction heading two lines below the key words, centered and bold in capital letters.

Headings and Subheadings—Using 10 point Times New Roman, center major headings in capital letters and bold. Using 10 point Times New Roman, subheadings should be bold and placed flush left with a capital letter beginning each word. Subheadings of subheadings, if used, should be bold and indented five spaces. Capitalize only the first word of the sub-subheading.

First Line of Text—Do not indent. Do not underline any words.

Preparation of Tables and Figures

Do not put boxes around the figures.

Tables — All tables must be placed within the text of the paper as close to the text reference as possible. An extremely wide table may be turned on one of its longer sides, with the table heading centered directly above the table.

Do not include tables that depend on color for meaning. CD-ROM of proceedings will show color, but print version will be black and white only. Include headings above all tables. Any symbols used in a table must be defined in a formal nomenclature immediately following the table in which they are mentioned. Each table must have a caption typed directly above it.

Figures — All line drawings, photographs and halftones must be placed within the text of the paper as close to the text reference as possible. Photocopies of figures reproduce poorly and are not acceptable. **Do not include figures that depend on color for meaning. CD-ROM will show color, but print version will be black and white only.**

Line drawings — Line art must be computer-generated. Lettering must be in English and legible.

Halftones — These are reproductions of a photograph into a dot pattern. The screening process can be done by a printer or graphic art photographer. A 100-line screen is best to use when having halftones made from photographs. *Photographs must be screened before they are used within the text of the paper. Color photographs may be used since CD-ROM of proceedings will show color. However, print version will be in black and white only.* Each figure must have a caption typed directly below it. Captions are single-spaced.

Numbering Tables and Figures — Number tables with Roman Numerals according to their order of appearance in the text. Example: Table I, Table II. Number figures with Arabic numerals. Example: Figure 1, Figure 2. In appendices, do not continue the numbering sequence from the text of the paper, but number tables and figures as: Table A-1, Table A-2, Figure A-1, Figure A-2, etc.

Equations

Equations are set off from the text by a double space above and below the equation. Equations are numbered with Arabic numerals, with the numerals placed in parentheses directly across from

the last line of the equation, at the right-hand border. List and define equation symbols in a nomenclature immediately following the equation.

Abbreviations

If there is any doubt concerning the abbreviation of a term or word, spell it out. For long terms or names that will be used more than once, spell them out on the first reference, place the abbreviation in parentheses immediately after the term or name and use the abbreviation on all further references. Abbreviations for weights, distances, heights and other measurements can be found in most standard American dictionaries.

Use of Metric Units

Either SI metric or customary units of measure may be used in the paper; however, use one or the other consistently, rather than a combination. A conversion factor table at the end of the paper should list the factors necessary to convert from one system of units to another.

References

Reference numbers within the text are placed immediately after the final word or punctuation mark of the sentence in which the reference is first mentioned. The reference number is placed slightly above the line of type (superscript). Use Arabic numerals for all references.

Each paper *must* include a complete list of references, numbered consecutively in their order of appearance within the text. Single space all reference entries. Examples of references follow:

Article: Name(s) of author(s), article title (in quotations), publication title (in italics), volume, number, date and inclusive pages.

1. J.A. Bartnik and C.F. Giermark, "Chemical Magnetic Flocculation Process," *The Canadian Mining and Metallurgical Bulletin*, Vol. 62, No. 3, June 1969, pp. 263-266.

Book: Name(s) of author(s), chapter title (in quotations), book title (in italics), name of publisher, city and state or country of publication, date of publication and inclusive pages.

2. M.X. Misal, "Crankcase Oil as an Edible," *Physical Principles of Oil Production*, McGraw-Hill Co., New York, NY, 1949, pp. 27-30.

Unpublished Paper: Name(s) of author(s), title of paper (in quotations), name of conference at which paper was presented (in italics), city and state or country in which conference was held and date of conference.

3. W.H. Bailey, "Refining and Casting of Large Forging Ingots," *Metals Society Conference*, Sheffield England, July 1975.

For all reference entries, author name(s) should be listed as follows: first initial, middle initial and last name.

Appendix

If an appendix is included in the paper, follow the instructions appropriate to the material. Each topic should be listed as a separate appendix, and each appendix labeled with a Roman numeral (Appendix I, Appendix II, etc.)

Permissions/Releases

It is the author's responsibility to acquire any necessary permissions before submitting the paper to AIST. Once the paper has been submitted, you must assume the paper will be published.

AIST is not responsible for any issues that may arise concerning the content of your paper.

Multiple Submissions

Before submitting your paper, please review the content to be certain it reflects your intent and obtain any permissions/releases that may be necessary. Repeatedly sending corrected copies of your manuscript may cause the wrong submission to be published.

Submission Instructions

E-mail your manuscript to the address provided in your acceptance letter or mail disk/CD-ROM to the attention of the Technical Program Coordinator at:

Association for Iron & Steel Technology
186 Thorn Hill Road
Warrendale, PA 15086-7528
U.S.A.

12 point Times New Roman, bold, centered, caps and lowers

Basic Slag Generation in Steel Making Processes – With Special Reference to the BOF

Dr. Ian D. Prendergast
AK Steel,
1801 Crawford St,
Middletown, Ohio 45043
Phone – (513) 425-3958
Fax – (513) 425-4077
E-mail: iprendergast@aksteel.com

10 point Times New Roman, centered

Key words: Slags, Optical Basicity, BOF, Magnesia demand

INTRODUCTION

10 point Times New Roman, bold, centered

High temperature metallurgical processes are generally batch (BOF, EAF, AOD, TBRC, etc) or semi-continuous (converters, smelters, etc). In all of these processes the conditions and reactants are controlled as closely as possible and lead to a vessel equilibrium condition at the desired end of the batch process. This particular review discusses the BOF process and in particular the generation of basic oxide slags from a combination of fixed and variable additions. These slags reach an individual equilibrium value at the end of that specific process, which can be described using optical basicity. This paper describes the underlying theory, assumptions and results from two operations. (The material draws from two BOF operations at AK steel, but data from other operations reinforce the findings).

10 point Times New Roman, justified

DISCUSSION

In present day BOF steelmaking, slag generation is secondary to carbon removal, although in recent years, a closer slag control has been exercised with increased control of additions of lime and magnesia. However, the magnesia addition is based on some guesswork, but can be combined with observations of the laser measurements and wear effects on the lining, whether a gunning program or slag splashing practice is followed or not. The present paper attempts to define the variables and analyze the end-point of the slag equilibrium process. Unpublished work suggests a similar analysis can be successfully applied to other batch processes, e.g. EAF, AOD, TBRC, etc. (NOTE – All values are in mole fractions).

A standard BOF charge is comprised of blast furnace molten iron and selected scrap. Lime is added to act as a neutralizer for the acidic silicon, aluminum and phosphorus oxides generated during the decarburizing oxygen blow, as well as absorb or prevent inversion of residual sulphur. A magnesia source is also added, as it has been known since the initial trials of basic steelmaking and melting processes, that basic slags generated through these processes have a minimum demand for magnesia (incorrectly called ‘magnesia saturation’). An examination of slags generated for individual heats, and the principal constituents, gives the following breakdown as to their source, quantity and chemical characteristics (Table I).

Table I. Slag components in BOF operations

Constituent Oxide	Source	Quantity / Variability	Oxide Class
Aluminum	Iron / scrap (lime)	Fixed	Acid
Calcium	Lime	Fixed	Base
Iron (Ferrous)	Iron / scrap	Variable	Base
Iron (Ferric)	Iron / scrap	Variable	Acid
Magnesium	MgO addition / refractory	Variable	Base
Manganese	Iron / scrap	Fixed	Base
Phosphorus	Iron / scrap	Fixed	Acid
Silicon	Iron / scrap / FeSi	Fixed	Acid
Sulphur	Iron / scrap (lime)	Fixed	Acid

(Splashed slag also supplies material additions and this, along with trace elements such as titanium, chromium and nickel; etc will not be covered here.)

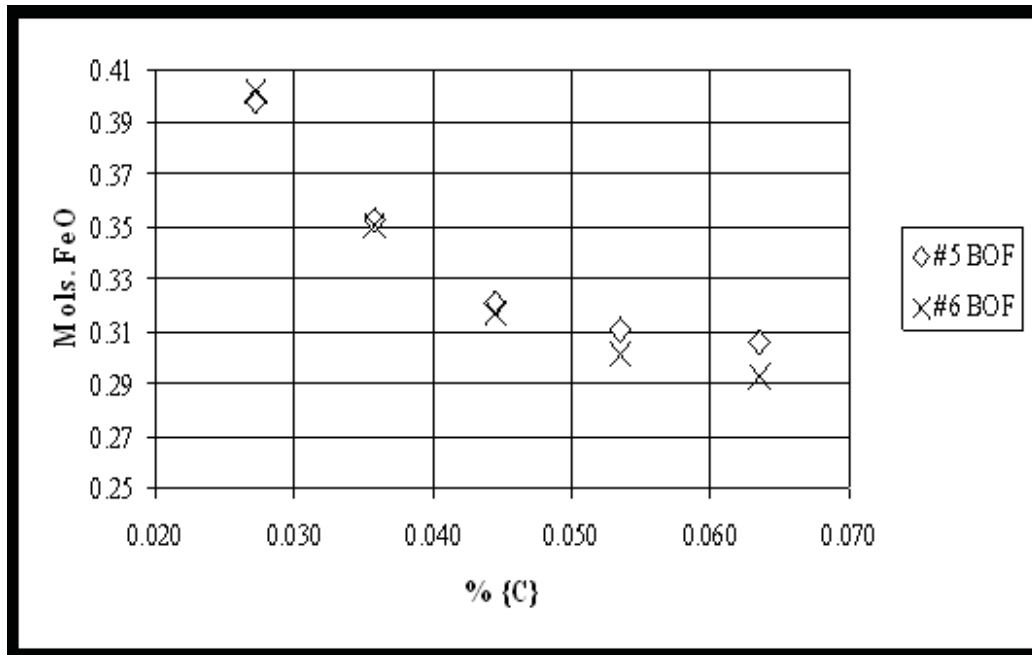


Figure 1. Mols. FeO vs. % {C}

10 point Times New Roman, lowercase, centered on figure

RESULTS

In the case of the present work reported here, a comparison of two BOF operations is shown in Tables III and IV. Table III shows the total range of chemistries for the two operations (average and standard deviation). These then translate into the slag 'description' shown in Table IV. The standard method of describing the turndown slag has historically been the straight lime / silica (V ratio – values shown here based on molecular weights), or it can try to incorporate some of the other oxides, which leads to 'Excess Base' and 'Non-bridging Oxygen' (NBO – see below) to name but a few 2, 3. However, these approaches are not very accurate or predictable, as shown with the standard deviation values. The approach that has merit, and has previously been shown to be applicable is the 'Optical Basicity'. The variability of this value is extremely low, but appears to be only applicable on an individual basis to each BOF operation and then only on heats that have not been re-blown.

10 point Times New Roman, bold, centered

SUMMARY

The end point of the initial blow in the BOF steel-making process generates an equilibrium slag that can best be described by an Optical Basicity value. This value is dependant on oxidation levels, temperature and specific vessel. Further, the overall molecular composition of the slags shows consistency and predictability.

ACKNOWLEDGMENTS

The author wishes to thank AK Steel as well as my colleagues and the numerous steel mills I visited over the years. I would also like to thank Prof. I. D. Sommerville - Univ. of Toronto, Prof. J. J. Moore – Colorado School of Mines, Prof. I. Harrison – Penn State and Ing. Manuel Rodiles of Hylsa.

REFERENCES

1. John D. Anderson Jr., "Introduction to Flight," McGraw-Hill, 1978, 357.
2. Ed. – J.J. Moore, "Chemical Metallurgy," Butterworth-Heineman Ltd., 1981