



Author Guidelines – UNITECR 2013

Manuscripts should be submitted as “camera-ready”. Papers **will not** be edited before printing. Please read and follow the guidelines below.

The Basics

1. **Page Limit:** Papers cannot exceed 6 pages.
2. **Margins:** Use 1-inch margins on all sides when using 8 ½ x 11 inch paper. For A4 paper, use 2.5 cm (1 in) on the top, 2.2 cm (0.9 in) on the sides and 4.4 cm (1.7 in) on the bottom.
3. **Two Column:** Except for title and author information on the top of the first page, each page should be separated into two columns and the columns must have a gutter space of 7 mm (0.25 in). (You can cut and paste using the template provided or you may refer to MS Word template or choose Format/Columns).
4. **Font:** All text must be in 12 point Times or Times New Roman
5. **Spacing:** All text must be single-spaced. Add a space before each heading or subheading.
6. **Indenting:** Indent each paragraph by one tab.

Parts of the Paper

1. **Title:** The title should be centered at the top of the page. Letters should all be uppercase except for compounds and chemical formulas (e.g., Al₂O₃ not AL2O3), do not bold. Use 12-point Times or Times New Roman font.
2. **Author info:** Begin the author information centered two lines below the last title line. Use upper and lower case, 12-point Times or Times New Roman font. The presenter of the paper should be marked with an asterisk (*) after the last name.
3. **Body text:** Text should be 12-point Times or Times New Roman font. The first line of text should be indented one tab and should appear directly below the heading (no blank line). Text alignment should be justified.
4. **Headings and subheadings**
 - Headings: 12-point Times or Times New Roman font, all uppercase letters (no bold or italics).
 - Subheadings: 10-point Times or Times New Roman font, upper and lower case letters (no bold or italics)
5. **Spacing:** Between the last line in the author information and the first main heading, there should be one space and then one continuous section break (To insert a continuous section break, choose “Insert,” then “Break” and then click on the radio button next to “Continuous.”).

Illustrations, Tables, etc.

1. **Figures:** Figures in the text must be indicated in the form of “Fig. 1” followed by a brief description in 12 point font and place below the figure.

2. **Tables:** Number tables with Roman numerals (i.e.; I, II, III, etc.) followed by the table title and place above the table.
3. **Images:** All scanned image files must be saved as an a TIFF file and should be placed at 100% of the original size. Micrographs and other halftones should be at least 300 dpi (dots per inch) and line art should be at least 900 dpi. Crop and place images in your electronic document where you want it to appear in the paper.
4. **Units:** The International System of Units (SI) must be used to indicate units.
5. **Equations:** Equations should be centered and separated from the text by one blank line above and below. Number equations consecutively in parentheses at the right-hand margin, in line with the last line of the equation.
6. **References:** Number references consecutively in the text with superscript numbers, and list corresponding references at the end of the paper.
- 7.

Embedding images into a Word document

- To insert an image/figure into a Word document, you simply put the cursor where you want the picture to go, click on "insert," then "picture," then "from file." There is no other way to do it.
- It is important to realize that when a figure has type in it, that type will carry all the way over to press. So it is important that the fonts are included at every stage, i.e., they must be embedded in the PDF (see below).
- If a figure is scanned, there are no fonts, just pixels, so fonts are not a problem, but scanned figures must be at high resolution to reproduce well in print.

Embedding fonts in PDFs

This is the procedure for making PDFs with fonts embedded:

- 1) When "printing*" the Word document to a PDF, click on "Properties" in the print dialogue box.
- 2) Next click on "Adobe PDF Settings."
- 3) Then open "Standard."
- 4) You will then see a tab for "Fonts" to the right. Click on that.
- 5) Make sure there is a check mark in the "Embed all fonts" box at the top.
- 6) Make sure there is a check mark in the "Subset and embed . . ." box.
- 7) The percentage in the window should be "100%."
- 8) The "When embedding fails" box should say "Cancel job". (This makes it impossible to produce a PDF with missing fonts.)
- 9) The "Font source" window lists all of the fonts on your system. Highlight all of the fonts on the left, click on the "Add" in the middle, and the fonts will appear in the "Always embed" box on the right. There should be nothing in the "Never embed" window.

Once you make these changes, they should apply to all future PDFs.

*** "Printing" to PDF is actually saving a document as a file; the word "printing" is deceiving in this case.**

Sample paper: A sample paper can be found on the following 2 pages.

REACTION CHEMISTRY AND MICROSTRUCTURE DEVELOPMENT OF MgO-C REFRACTORIES CONTAINING METAL ANTIOXIDANTS

J.P. Guha* and J.D. Smith
University of Missouri-Rolla, USA

ABSTRACT

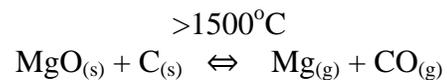
Phase formation and their stability during firing MgO-C refractories with minor additions of Al-metal were studied at temperature between 600° and 1200°C in an atmosphere of argon. The phases formed at different stages of the reaction process were identified by powder x-ray diffraction and scanning electron microscopy. At the initial stages of the reaction process, a liquid phase containing Al and Mg, was formed at a temperature below the melting point of Al-metal (660°C). The liquid, once formed, coexists with MgO and C at temperatures up to 850°C and then slowly dissociates to molten Al and Mg-gas above this temperature. With the continuation of the reaction, the molten Al reacted with C to yield Al₄C₃ in the form of thin platelets, whereas, the Mg-gas combined with the oxygen present in the furnace to yield MgO in the form of whiskers on the cold-face of the refractories. At temperatures above 1000°C, Al₄C₃ reacts with MgO to form spinel, MgAl₂O₄. Since MgAl₂O₄ is compatible with both MgO and C, no further reaction occurred in the refractories.

INTRODUCTION

For the last several years, refractories based on MgO and C, which are known to possess excellent resistance to thermal shock and slag-corrosion at elevated temperatures, have found extensive application in steel-melting processes, especially, in the basic oxygen furnace (BOF). However, the life of these refractories becomes somewhat limited on prolonged use under severe operating conditions due mainly to poor oxidation

resistance and low strength of these materials at high temperatures. During the last several years, several studies¹⁻⁶ have been carried out to improve the service-life of these refractories by (i) using high-purity starting materials, (ii) controlling the grain-size of MgO, and (iii) addition of small amounts of metal and metallic alloys to the starting compositions. It has been recognized in these studies that the property enhancement of these refractories takes place by the interactions of the metallic additives with MgO and C leading to the formation of several secondary phases, which coexist with MgO. In general, the metal and/or alloy preferentially react with C at a significantly low temperature to yield metal carbides, which, once formed, remain stable as a discrete phase in the bulk of the specimens. Thus, Al-metal reacts with C to form Al₄C₃, whereas, Si-metal reacts with C to yield SiC. It is generally believed that the presence of one or both of these carbides in the bulk of the specimens leads to an enhancement of the hot-strength of the refractories.

A major problem of high-temperature use of the MgO-C based refractories is the carbothermal reaction that occurs between MgO and C at temperatures above 1500°C. This reaction leads to a partial loss of both Mg and C from the refractories as shown by the following equation:



Thus, on prolonged exposure to temperatures above 1500°C, Mg-vapor is

formed and progressively removed from the interior to the cold surface of the refractories. As the Mg-vapor comes in contact with the oxidizing atmosphere in the furnace, it reoxidizes to MgO and forms a dense layer adjacent to the hot-face of the refractories. The formation of this MgO layer leads to an increase in the oxidation resistance of the material during operation at high temperature.

RESULTS AND DISCUSSION

From the various data obtained in this investigation, it was observed that Al preferentially reacts with MgO at a temperature below the melting point of Al (660°C) to yield a metallic alloy composed of Al and Mg. It is evident from the phase diagram of the system Al-Mg₇ that two binary compounds i.e. Al₃Mg₂ and Al₁₂Mg₁₇ occur within a small homogeneity range. The phase diagram also shows that both the compounds melt at temperatures below 500°C. Thus, the reaction of Al-metal with MgO, which seemed to commence at a temperature below the melting point of Al, led to the formation of a Al-Mg phase, which was found to be molten at the reaction temperature. It was further observed that the stability of this metallic phase was largely dependent on the firing temperature and the oxygen partial pressure prevailing in the furnace during firing. Evidence obtained in this investigation indicated that this metallic phase coexists with MgO up to 850°C and then dissociates into molten Al and Mg-vapor above this temperature. It should be noted that the dissociation of this metallic phase largely depends on the rate of heating of the specimens. Thus, with a heating rate of 10°C/min, the Al-Mg phase was found to dissociate at a temperature above 850°C. Microstructures of several compositions containing MgO with minor additions of Al, which were fired at temperatures between 600° and 1000°C, revealed the presence of a

reaction product in the form of a molten mass embedded in a fine-grain matrix of MgO. A SEM micrograph of a specimen containing 10 wt % Al, which was fired at 1000°C in argon, is shown in Fig.1.

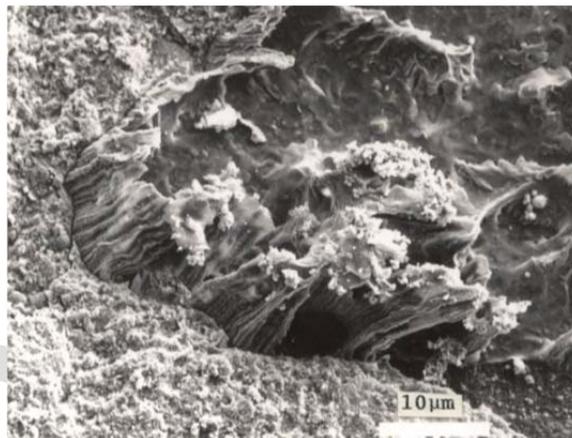


Fig. 1. SEM micrograph of MgO containing 10 wt% Al. The specimen was fired at 1000°C for 1h in argon.

REFERENCES

1. A. Watanabe, H. Takahasi, T. Matsuki and M. Takahasi, "Effects of Metallic Elements Addition on the Properties of Magnesium Carbon Brick", Proc. 1st Int. Conf. on Refract., Tokyo, Japan, pp 125-34 (1983).
2. A. Watanabe, H. Takahasi, T. Matsuki and M. Takahasi, "Some Properties of Magnesia-Carbon Bricks Containing Mg and Al", Taikabutsu Overseas, 5 [2] 7-12 (1985).
3. A. Yamaguchi and T. Matsuda, "The Effect of Al and Alloy Additions on the Properties of Carbon-Containing Refractories", Proc. 2nd Conf. on Refract., Tokyo, Japan, pp. 915-24 (1987).