THE CHEMISTRY AND TECHNOLOGY OF MAGNESIA

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PREFACE

This book attempts to encompass “all things magnesia.” Although the magnesia industry is similar in many respects to the much larger lime industry, there is to my knowledge no text concentrating solely on magnesia. There are, however, several excellent texts covering the lime industry. Unfortunately, in these books magnesia is practically a footnote. Although lime and limestone production far exceeds that of the magnesia industry (total lime production in the United States in 2004 was 20.4 million metric tonnes, compared with a total magnesia production of 280,000 metric tonnes), magnesia is still an important chemical and maintains many niche applications. By far, the largest consumer of magnesia worldwide is the refractory industry, which consumed about 56% of the magnesia in the United States in 2004, the remaining 44% being used in agricultural, chemical, construction, environmental, and other industrial applications.

This text starts with the geological occurrences of magnesite and brucite, followed by the processing of magnesite to the end product magnesium oxide. The production of magnesium hydroxide and magnesium oxide by precipitation from seawater and brine sources is also introduced, along with details on the wide range of applications in which magnesia is utilized. These applications span animal feed to wastewater treatment, catalyst support and fertilizers to the production of pulp and paper.

Like many industries, a certain amount of jargon arises as the industry matures, and the magnesia industry is no exception to this. However, there may be some confusion as to which compound magnesia really applies.
My definition is that the term *magnesia* is a generalization for magnesium oxide, whether it is derived from natural magnesite or extracted from seawater or brine. The term *magnesite*, in the strictest sense, refers to the mineral consisting of magnesium carbonate, but the same term is often used for the oxide, that is, *dead-burned magnesite*, the term even being used when the oxide has been produced from seawater or brine sources.

The major products produced by the magnesia industry are magnesium carbonate (magnesite); magnesium hydroxide, both natural (brucite) and that derived from seawater and brine; magnesium oxide, which in itself has a number of categories, namely, light-burned or caustic-calcined MgO, hard-burn MgO, and dead-burn MgO, or as it is otherwise known, periclase; and the last category, fused magnesia.

Light-burn or caustic-calcined MgO refers to a product that has been calcined at the lower end of the temperature spectrum, typically 1500–1700°F. This product typically has the highest reactivity and greatest specific surface area of the entire magnesium oxide category. Hard-burn MgO is calcined at a higher temperature, 2400–2800°F, and has a correspondingly lower reactivity and surface area. Dead-burn MgO, or periclase, is produced at temperatures above 2800°F, which having a very small surface area, makes it unreactive. Finally, fused magnesia, produced at temperatures above the fusion point of magnesium oxide (2800°C), is the least reactive.
ACKNOWLEDGMENTS

First and foremost, I am indebted to my wife Karen, whose encouragement kept me working during periods when my enthusiasm waned, and also to my kids, Alex, Victoria, and Madalyn, whose persistent question “haven’t you finished that book yet?” also provided the needed impetus to get the text finished.

I also owe a debt of gratitude to John Gehret and the board of directors of Premier Chemicals, LLC for allowing me the opportunity to write the book. I would also like to especially thank my long-time friend and mentor, Dr. Ronald Wardle, along with John Noble of Vesuvius USA and Mark Wajer of Martin Marietta Magnesia Specialties for diligently correcting the text and providing helpful suggestions. I would also like to thank Lynden Johnson for increasing my knowledge of the process of mining magnesite.

Finally, I would like to thank Gerry Spoors, Dr. Theofilos Zampetakis, and John Turner for their affirmation that this book should be written, and to John Wiley & Sons for agreeing to publish said text.