Introduction

Very early in man's development of permanent structures lime was employed as a cementing agent in mortars to bond stones together. Later it was used with aggregate and gypsum for surface treatment of structures and for art work. The Romans, first to build an extensive highway network, frequently used lime to improve the stability of base courses. Existence of some of these highways attests to the success of their methods. Chemical uses for lime developed concurrently with structural uses. The historic uses of lime continue today with new applications being reported frequently.

Lime is one of the basic materials of our industrial complex. It ranks essential with salt, sulfur, iron ore, and fossil fuels. The annual world consumption of lime and its ore, limestone, exceeds two billion tons.

This symposium was organized to present recent findings of pure and applied research directed toward a better understanding of the fundamental properties of lime and the effect variations in these properties have on certain end uses, and test methods developed to better evaluate this enigmatic chemical.

Several investigators have used the scanning electron microscope to give visualization of the time-temperature dependent physical changes occurring to lime oxide during and after its formation from limestone. With measurements of surface area and pore size distribution these special micrographic techniques permit anticipation and interpretation of the chemical behavior of lime oxide under widely varying conditions.

Even though masonry construction represents the oldest known use of lime, the trend toward thin-wall construction requires a fuller understanding of the short- and long-term properties of lime mortars. The authors of the papers on mortars report on investigations of lime mortar curing by current ASTM method of test, field exposure of lime mortar-masonry assemblages, and evaluation of mortar specifications by test methods.

The studies of the rate-of-hydration methods used to characterize the reactivity of lime oxide show good correlation, and the data can be related to that obtained by more sophisticated means. The hot wire microscope was designed to study steelmaking oxide reactions in controlled atmosphere at temperature. Observations of the solution of lime oxide in slags at 1500 to 1650 C strongly suggest a similar rate-controlling mechanism in both slagging and hydration reactions. The data from crucible scale and produc-

tion furnace studies of the rate of solution of lime oxide in slags reinforce this interpretation. Scanning electron micrographs supply further confirmation with certain limitations established by pore size measurements.

Control of the sulfur dioxide content of the gaseous combustion products of fossil fuels is a major concern to the industrial community. A number of continuing research projects in this field are being sponsored by the Federal Government and industry. Limestone and lime will react with sulfur dioxide under certain conditions to form stable compounds. The determination of the parameters controlling these reactions is the subject of several symposium papers.

The advent of basic pneumatic processes for rapid refining of iron into steel has emphasized the need for studies of the physical and chemical properties of lime and, particularly, rate of change of these properties at steelmaking temperatures. One cannot read this symposium volume without being impressed by the reinforcement the reported investigations lend to each other, especially in the area of conditions controlling rates of reaction. The development and use of lime oxide premixed with either iron or aluminum oxide resulting in an increased reaction rate and efficiency is first reported in this symposium. The subsequent possibility of reducing refining time is of major economic import.

The recent symposium on soil stabilization, sponsored by ASTM Committee D-18, precluded related papers in this symposium volume.

It is the sincere hope of the sponsoring Committee that the investigations reported herein will stimulate additional research on lime and limestone and related end uses.

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