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LOCAL MATERIALS

Technological characteristics of the calcined limestone from Agios Panteleimonas, Macedonia, Greece

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ABSTRACT

The gray-green limestone from Agios Panteleimonas is studied in this paper after submitting it in special technological analyses in order to determine the possibility for quicklime production. Cubic test specimens with mean 50 mm edge length were calcined at 850, 950 and 1,050°C, with 150 min preheating time and 120 min retention time at each calcination temperature. At the dissociation temperature of pure calcite (898°C) only one half of the initial limestone has been calcined. The dissociation of the specimens started at 740°C and almost completed at 1,050°C. Probably, the large edge length of the cubic specimens and the low retention time are responsible for the incomplete calcination at 1,050°C. The dry apparent weight of the calcined limestone (1.577 g/cm^3), its low shrinkage (0.1-0.3%), the 2% impurities content and the 24% value of the attrition and abrasion resistance, characterize this quicklime and classify it to the high quality products.

RÉSUMÉ

Dans cet article, le calcaire gris-vert d'Agios Panteleimonas est étudié par rapport à la possibilité de son utilisation pour la production de chaux, après avoir été soumis à des essais technologiques spéciaux. Des éprouvettes cubiques de 50 mm de côté ont été calcinées à 850, 950 et 1 050°C, chauffées pendant 120 min à chaque température, après leur préchauffage pendant 150 min. La dissociation des éprouvettes a été réalisée par augmentation de la température de 740°C à 1 050°C. Dans ce cadre, seulement la moitié du calcaire initial a été calcinée à la température de dissociation de la calcite pure (898°C). La grande taille des éprouvettes et la courte durée des essais, sont responsables de la calcination incomplète, à la température de 1 050°C. La masse volumique apparente sèche du calcaire calciné (1,577g/cm^3), son retrait faible (0,1-0,3%), le taux d'impuretés (2%), le coefficient d'attrition (24%) et la résistance à l'abrasion, caractérisent cette chaux vive et la classent comme étant un produit de haute qualité.

1. INTRODUCTION

The principal chemical property of limestone is its thermal decomposition. It is due to this characteristic that lime manufacturing was created by the process of calcination. This process commences on the exterior surfaces and progresses inwards as the surrounding temperature increases. As the release of CO_2 involves a general weight loss of 40-44% the porosity of the material is increased giving a mass of CaO with a large internal surface area and hence, high chemical reactivity.

There are numerous critical variables in limestone calcination that can exert a serious effect on lime quality. In decreasing importance such variables may be [1]: Degree of calcite crystallinity, types and quantities of impurities, rate of calcination, calcination duration and temperature, chemical reactivity, shrinkage etc. Burning technology and kiln design are also important factors in determining the quality of the lime.

For high quality lime production the limestone may present the following main demands [2]: $CaCO_3$ > 98.6% and SiO_2 < 1%. However, limestones with $CaCO_3$ content > 95% may produce common lime [3].

The diverse limestone types, based solely on their calcination behavior, may be arbitrarily categorized in the following four groups [1]:

I. Those that fracture and decrepitate readily during preheating and at low calcination temperatures.
II. Those that yield a porous, reactive lime under most calcination conditions and that are difficult to overburn.
III. Those that yield a dense, unreactive lime of low porosity even under the mildest calcining conditions.
IV. Those that yield a porous, reactive lime under mild temperature conditions and a denser, less porous lime

Editorial note
The authors work at the Aristotle University of Thessaloniki, a RILEM Associate Member.

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