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The role of organic matter of carbonate rocks in the reactivity of the produced quicklime

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ABSTRACT

The gray and white crystalline limestones from Agios Panteleimonas Florina have almost the same mineralogical composition. They are mainly composed of calcite (96%), while the percentage of the contained organic matter is 0.8% in the gray and 0.09% in the white crystalline limestone. After heating both crystalline limestones at 500°C no serious change was observed concerning their mineralogical composition. However, the velocity of P waves and the porosity in the gray limestone are changed significantly while this trend is not noticed in the white limestone. These changes are mainly attributed to the burning of organic matter, which is contained with greater percentage in the gray crystalline limestone. At 1000°C both crystalline limestones are completely calcined. The dissociation of calcite and dolomite increases significantly the porosity of the produced quicklime. The quicklime from gray crystalline limestone presents higher porosity value (by 5.2 percentage units) and it is more reactive (by 4.9 percentage units) in comparison with the quicklime from white crystalline limestone. This difference in the reactivity is mainly attributed to the difference in the percentage of organic matter contained in the two crystalline limestones.

RÉSUMÉ

Les calcaires cristallins, gris et blancs, de Agios Panteleimonas Florinas, ont à peu près la même composition minéralogique. Ils sont composés essentiellement de calcite (96%), tandis que le pourcentage de la matière organique contenue est de 0,8% dans le gris et 0,09% dans le calcaire cristallin blanc. Le chauffage de ces deux calcaires cristallins à 500°C n'apporte aucun sérieux changement concernant leur composition minéralogique. Toutefois, la vitesse des ondes P et la porosité du calcaire gris ont considérablement changé, tandis que cette tendance n'est pas notée dans le calcaire blanc. Ces changements sont attribués à la combustion de la matière organique, dont le pourcentage est plus élevé dans le calcaire cristallin gris. À 1000°C les deux calcaires cristallins sont complètement calcinés. La destruction de la calcite et de la dolomite augmente considérablement la porosité de l'asbeste produit. L'asbeste produit par le calcaire cristallin gris présente une valeur de porosité supérieure de 5,2% et il est plus réactif (de 4,9%) en comparaison avec l'asbeste produit par le calcaire cristallin blanc. Cette différence de réactivité est essentiellement attribuée à la différence du pourcentage de matière organique contenue dans les deux calcaires cristallins.

1. INTRODUCTION

Limestones almost always contain a quantity of organic matter, usually less than 1% [1]. Typical range of carbonaceous matter that is contained in commercial limestones is 0.01 to 0.5% [2]. The porosity of carbonate rocks varies considerably depending on the degree of compaction and their structure. Typical values (by volume) are 0.1 to 2% for marble, 0.1 to 30% for limestones and 1 to 10% for dolomites [2].

The porosity of commercially produced quicklime can be as high as 55% (by volume), when a porous limestone is lightly burned. Exposure to elevated temperatures for a long retention time results in sintering, which can reduce the porosity down to 30%. Part of the porosity of the particles of commercial quicklime is caused by the porosity of the limestone, and part by the decomposition process of the carbonate minerals [2].

Porosity, density, mineralogical composition and pore size distribution of the carbonate rock are some of the parameters that have significant influence on basic lime properties such as reactivity, water-soluble CaO and

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The Aristote University of Thessaloniki is a RILEM Associate Member.