

On the use of thermal properties for characterizing dimension stones from Portugal

A. Correia^{1,2}, L. Lopes^{1,3}, P. Rebola⁴

¹Centro de Geofísica de Évora, Universidade de Évora, Portugal, ²Departamento de Física, Universidade de Évora, Portugal, ³Departamento de Geociências, Universidade de Évora, Portugal, ⁴Cevalor, LEM, Portugal

It has been usual practice to measure physical and mechanical properties of dimension stones; however, the same is not true for thermal properties, such as thermal conductivity, thermal diffusivity, specific heat capacity, and heat production which are particularly important when processes related with heating and cooling of buildings must be considered. Thermal conductivity, thermal diffusivity, and specific heat capacity are related with the way thermal energy is transmitted and accumulated in stones; heat production is related with the amount of radioactive elements on the rocks. Several rock samples from several quarries were collected in Mainland Portugal for measuring their thermal conductivities, thermal diffusivities, specific heat capacities, and heat productions.

The rock set consists of granites, limestones, and marbles used in architecture and civil engineering. The results of the study indicate that the collected granites have thermal conductivities, thermal diffusivities, and specific heat capacity that vary from 2.98 ± 0.09 to 3.24 ± 0.21 W/m.K, 1.32 ± 0.03 to 1.55 ± 0.12 ($\times 10^{-6}$) m²/s, 2.10 ± 0.04 to 2.26 ± 0.04 J/m³.K, respectively; the collected limestones have thermal conductivities, thermal diffusivities, and specific heat capacity that vary from 2.77 ± 0.02 to 3.07 ± 0.03 W/m.K, 1.26 ± 0.01 to 1.42 ± 0.03 ($\times 10^{-6}$) m²/s, 2.16 ± 0.05 to 2.32 ± 0.04 J/m³.K, respectively. The average thermal conductivity, thermal diffusivity, and specific heat capacity for marbles is 2.90 ± 0.03 W/m.K, 1.31 ± 0.03 ($\times 10^{-6}$) m²/s, 2.22 ± 0.07 J/m³.K. The average heat production per unit volume for the granites is 2.75 (0.25) μ W/m³.