E. Rambaldi *, F. Prete, G. Timellini (Centro Ceramico Bologna, Italy)

* e-mail: rambaldi@cencerbo.it

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The contemporary progress of innovative building materials aims at attaining an efficient building energy management and it answers to the requirements of thermal and acoustic technical standards.
Nowadays there is a growing trend in using the radiant floor heating system for domestic applications, being one of the more widely used heating system in northern Europe countries.
Floating tile systems are currently used also in domestic environment in order to reduce walking noise or vibration.
Both for thermal and acoustic performances computer simulations about the effect of several design parameters on the floor heating system and on the floating tile system have concluded that the most important factors are the floor material type and thickness.
Traditional ceramic tiles are the base for modular products which can be applied anywhere, such as new buildings or retrofitting of existing buildings. Porcelain stoneware tiles may be effective floor coverings for radiant floor heating due to their good thermal conductivity compared to other floor coverings like carpets of vinyl.
A lot of works are available in literature about the processing of ceramic tile materials, the viability of different raw materials and new trends. However, their technical properties have been scarcely studied, being mainly focused on the mechanical properties. Only few works concerns the thermal and/or acoustic properties of clay based materials and even less of ceramic tiles.
In the present work, the thermal and acoustic properties of four commercial porcelain stoneware tiles having different composition and/or different thickness are analyzed in terms of thermal conductivity and reduction of walking noise. Furthermore, tiles coupled with other materials such as glass fibers or resilient materials are also analyzed.
The microstructure of the samples is analysed by a scanning electron microscope equipped with an energy dispersion X-ray attachment. The total porosity values are also calculated both on the basis of real density of the powdered fired samples conforming to the Standard ASTM C329-88 and by image analysis system to evaluate the pores dimension, shape and distribution. Quantitative mineralogical compositions of the samples are determined by X-ray diffraction analysis and the Rietveld-RIR refinements are performed using the software GSAS-EXPGUI. Determination of dynamic stiffness is carried out following the standard UNI EN 29052-1 by a resonance method. The walking noise reduction, ΔL_w, is measured according to the standard UNI EN ISO 10140-3 and the irradiated noise in the emitting chamber, $L_{n,walk}$, is determined by using a walking machine following the method described in the pr EN 16025. Thermal conductivity tests are carried out in accordance to the standard ASTM E 1530 by using the guarded heat flow meter technique.
In this way, a data base of thermal and acoustic properties of commercial porcelain stoneware tiles measured under similar conditions, useful for scientists and professionals of the floor tile market, is provided.