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PORCELAIN STONEWARE LARGE SLABS (LAMINA®): PROCESSING AND TECHNOLOGICAL PROPERTIES

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Lamina® products are porcelain stoneware slabs up to 360 x 120 cm² and 3 mm of maximum thickness, which can be bent and used in several applications, from building and construction (floorings, wall coverings, ventilated façades, tunnels, insulating panelling) to indoor furnitures (e.g. table tops, doors, panels). Lamina® slabs are manufactured through an innovative ceramic process, starting from pre-milled raw materials and involving wet ball mixing, powder granulation by spray drying, forming by special purpose presses, a single stage of fast drying and firing peaking at about 1200°C, and finishing (trimming, lapping, functionalization). Industrial samples were selected in order to investigate their technological performances as well as compositional and microstructural features. The following characteristics were determined: water absorption, open and closed porosity, bulk density; mechanical properties (modulus of rupture, Young modulus, fracture toughness, impact strength); resistance to deep abrasion, surface roughness; chemical and stain resistance; resistance to thermal shock and freeze/thaw cycles; phase composition; scanning electron microscopy on both surface and polished sections. In addition, microstructure and pore size distribution of the unfired body were investigated as well as its sintering behaviour. Lamina® products are characterized by outstanding performances for very large and thin porcelain stoneware slabs. Water absorption is very low (<0.1%) according to the fast sintering rate. Mechanical properties match the top quality range for porcelain stoneware tiles: modulus of rupture (60-70 MPa), Young modulus (68 GPa) and fracture toughness (1.3 MPa m^{1/2}), implying that the Lamina® process gives high strength but not stiff products, which are tough and little sensitive to relatively coarse pores (critical defect size ~200 µm). Standard technological requirements are fulfilled, being resistant to deep abrasion (160 mm³), chemicals, thermal shock and freeze/thaw cycles. Lamina® slabs exhibit a compact microstructure with closed pores (5-8%) to a maximum size of 50 µm, mostly with irregular shape. The phase composition, compared with conventional porcelain stoneware tiles, of Lamina® consists of a more abundant glassy phase (~80 wt%), a low content of quartz and a similar amount of new formed mullite.