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Glaze coupling in porcelain tiles: effects of the nature of the glazes in the tensions developed during firing

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In the last decade, the production of glazed porcelain tiles increased a lot in Brazil and the demand for tiles of large sizes was enhanced. The layers of engobe and glazes have important roles in this context because they are responsible for the aesthetic characteristics of the pieces and, simultaneously, they must allow the complete degasification of the body and to contribute to define the planarity of the tiles. The classical studies of glaze coupling, considering the differences of thermal expansion coefficients between support and glazes were developed in a different context, which the nature of the glazes and the firing temperatures were expressively different from the current conditions of production of glazed porcelain tiles. In this way, the main objective of this work was to evaluate the tensions developed during firing in the coupling of different combinations of engobes and glazes used in the production of porcelain tiles and to determine the effects of their characteristics on the refereed tensions. Specimens of 85 x 5 x 5 mm^3 were pressed with 380 Kgf/cm^2 using an industrial spray dried powder destined to the production of glazed porcelain tiles. The layers of different engobes and glazes were applied industrially by pulverization over the surface of the pressed bodies. After that, the specimens were fired at 1185^oC with optical monitoring of their deformation during the heating and the cooling, using the Optical Platform - ODP 868 - TA Instruments. Individual samples of engobes, glazes and grits for polishing were also characterized by dilatometric analysis and gresification curves, in order to determine their influence in the collected data. The microestrutural characteristics and the thickness of the applied layers were evaluated by scanning electronic microscopy. The results showed the importance of the thermal expansion coefficients of the glazes during the cooling step in the firing cycle. However, the analysis of the specimens containing layers of engobes and matt glazes indicated important changes in the curvatures of the pieces around the maximum temperature of the firing cycles. The results are explained by the sintering behaviour of the engobes and matt glazes, which present large volumetric fraction of crystalline phases. For this reason, the study concludes that controlling the thermal expansion coefficients of glazes and engobes are not enough to warrantee the required planarity of glazed porcelain tiles in the current conditions of production.