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COMPUTATIONAL SIMULATION OF THE POLISHING PROCESS OF PORCELAIN STONEWARE TILES

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ABSTRACT

High level of glossiness on floor tile surface is very appreciated by costumers, in spite of the polishing stage to generate massive costs in tile production. For porcelain stoneware tiles it often stands for 30% to the final cost. However, this cost can be reduced by optimizing either the scratching phenomena or the polishing kinematics, which is the subject of the present work. Kinematics optimization deals with the available motion of the polishing head, which in turn governs the path of each abrasive over the tile surface. This path can be analytically determined so that a model was elaborated to predict the trajectory of the abrasive particles for each instant. The goal of this work is to understand the glossiness distribution over the tile surface as function of the polishing kinematics, as well as the development of an aiding software. Apart from geometric paramenters, such as size of fickerts, the contribution of the following kinematic parameters were taken into account: advancing of the tile V (m/s), rotation of the abrasive disk W (rad/s) and frequency f (1/s) and amplitude A (m) of the tranverse oscillation of the polishing head. A computational modeling was then carried out using those kinematic parameters as input variables. The polishing enhancement was presented as output by using surface graphics. In these graphics each pixel corresponds to a small portion of a real tile surface. During the polishing process, the more polished is the tile surface the whiter will be the corresponding pixel in the graphic. Such graphics were then added in the resulting software to simulate a whole industrial polishing train. The software was made in LabVIEW 5.1, and a friendly interface was adopted. Users must use the proper knobs to select values for those operational parameters, inside a range commonly adopted in industries. All the simulations are made continuously in time, which aids the comprehension of the glossiness enhancement along the time. In addtion, the final glossiness pattern for a given kinematics can be estimated without subjeting real stoneware tiles, which implies in consuption of abrasives, water, energy as well as in generation of wastes. In order to check the model adequacy the values predicted were then confronted to those attained in literature, and also to some real values of glossiness, measured in an industrial polishing train. Good agreement was promptly achieved so that the software developed can be surely used as guideline for furthers studies on glossiness enhancement in ceramic tile industries.

Keywords: polishing simulation, glossiness, porcelain stoneware tile, computational simulation