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POWDER RHEOLOGY AND COMPACTION BEHAVIOR OF SPRAY DRIED BODIES FOR PORCELAIN STONEWARE SLABS

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The technological behavior of porcelain stoneware bodies strongly depends on the rheological properties and response to compaction of spray-dried powders during the deposition and pressing stages, particularly in the case of large slabs. Even the firing behavior betrays the features of powder compacts, especially in terms of shrinkage and densification kinetics. Although the literature offers some insights into the characteristics of spray dried powders for ceramic tiles, both red stoneware [1] and porcelain stoneware [2], no data are available on bodies currently utilized to manufacture large slabs (>4 m^2) by novel technologies [3-4]. In order to fill this gap, a systematic approach to properties and behavior of spray dried powders for porcelain stoneware large slabs was carried out within the IPERCER project [5]. For this purpose, nine industrially-manufactured spray dried bodies were characterized for particle size and agglomerate size distribution; shape, moisture and internal porosity in function of agglomerate size; rheological properties of powders (flowability, static and dynamic angles of repose, poured and tapped densities); compaction behavior (curves of bulk density, intergranular and intragranular porosity in function of applied load); firing behavior (effect of green porosity and density on firing shrinkage, bulk density, open and closed porosity, phase composition). The aim is to gather the information necessary to model the behavior during deposition (in mould or on tape) and pressing. Results reveal the occurrence of two types of spray dried powders in terms of agglomerate size distribution, even though most physical properties are similar. This has a significant effect on some rheological properties (flowability and tapped density, but not angles of repose), leading to some differences in the features of compacted bodies. The features of green compacts are somehow inherited by the fired bodies, even though the starting differences are damped in the fired bodies. In conclusion, there is room to improve the performance of spray dried bodies by pointing out a compromise between powders flowability, compaction and densification during firing. The challenge is to transfer this progress to the management of industrial spray driers, at present focused on energy efficiency and constancy in the moisture content.

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