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# Characteristics and Rheological Behaviour of Spray-Dried Powders for Porcelain Stoneware Slabs

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## Abstract

The technological behavior of porcelain stoneware bodies during deposition and pressing of large slabs depends on the rheological properties of spray-dried powders and the way they affect compaction. Although the literature offers some insights into the characteristics of spray-dried powders for ceramic tiles, no data are available on bodies utilized by novel technologies for large slabs (>4 m<sup>2</sup>). In order to fill this gap, a systematic approach to properties and behavior of spray-dried powders for porcelain stoneware slabs was carried out. For this purpose, twenty industrially-manufactured spray-dried powders were characterized for intrinsic features (particle size and agglomerate size distribution; shape and moisture distribution in function of agglomerate size) and rheological properties (mass flow, static and dynamic angles of repose, poured and tap density, Hausner ratio). The effect of intrinsic characteristics on the flowability of powders was appraised, as the mutual relationships between the rheological parameters, in order to unveil the best parameters to be used in ceramic tile production. Two broad classes of spray-dried powders occur with a finer and a coarser agglomerate size distribution. Results reveal that ceramic powders are free-flowing, with rheological properties fluctuating in a rather narrow range of values, which makes hard to see significant relationships among the various methods (the only strict correlation is between mass flow rate and tap density). Flowability mainly depends on the occurrence of coarser aggregates, particularly those irregular in shape, stemming from coalescence of three or more individual agglomerates. A phenomenological description of how the spray-dried powders behave in the deposition on tape and the early stage of compaction is outlined.

*Key-words:* agglomerates, porcelain stoneware, powder rheology, spray-dried powder.

## 1. Introduction

The manner by which spray-dried powders flow through the way out of hoppers and take place into the die or onto the tape affects the properties of green tiles, particularly their bulk density and mechanical strength [1, 2]. This behavior somehow depends on the intrinsic characteristics of spray-dried powders, namely the agglomerate size distribution, the shapes of granules and the moisture distribution in function of the agglomerate size. For these reasons, the concern on the rheological

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