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# Development of sapphirine opaque glazes for ceramic tiles

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## Abstract

The purpose of this work is to produce more excellent opaque wall tile glazes by using sapphirine instead of zirconium silicate as an opacifier. In order to achieve it, the chemical compositions were precisely adjusted in the system of  $\text{SiO}_2\text{-Al}_2\text{O}_3\text{-MgO-K}_2\text{O-Na}_2\text{O-B}_2\text{O}_3$ . The morphological characteristics of the glaze were determined by differential scanning calorimetry (DSC), X-ray powder diffraction (XRD) and scanning electron microscopy (SEM). And the optical properties of the glaze were characterized by a spectrophotometer and a gloss meter. The results reveal that well-shaped crystals of sapphirine ( $\text{Mg}_2\text{Al}_4\text{SiO}_{10}$ ) with needle-like morphology were formed as only crystal phase. The glaze is provided with better opacity whiteness and gloss compared with commercial zircon-based glass-ceramic glazes, and it is mainly composed of cheap mineral raw materials. Those features make it as an alternative one for improving the properties of conventional opaque ceramic glazes.

*Keywords:* Crystallization; Opaque; Glaze; Sapphirine

## 1. Introduction

Glass-ceramics are polycrystalline material that control the nucleation and crystal growth of the parent glass during heating so that the crystals are evenly distributed in the glass phase. Its excellent chemical durability and mechanical properties have attracted the attention of researchers and have been applied in various fields, one of which is the glass-

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