# OBTAINING COMPOSITES BY SINTER-CRYSTALLISATION OF A FRIT. EFFECT OF FILLER AMOUNT AND PARTICLE SIZE

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## INTRODUCTION

Previous studies have examined the mechanism and kinetics of viscous flow sintering of composites (GMCs) of the type: crystalline particles (filler) – glass matrix, and the effect on this process of the thermal variables, amount of filler, and frit and filler particle size. Using the results of these studies and those obtained on studying the mechanism and kinetics of frit particle sinter-crystallisation, it was sought to obtain composites in which densification took place by sinter-crystallisation of the glass matrix. In this case, the GMC microstructure consisted of filler particles embedded in a matrix consisting of small crystals dispersed in a glass, which must provide the material with good mechanical properties.

## RESULTS AND DISCUSSION

The selected glass matrix was a frit with the following chemical formula: $(SiO_2)(Al_2O_3)_{1/4}(MgO)_{1/3}(B_2O_3+Na_2O+K_2O)_{1/8}$.

The fired glaze (frit + 8 wt% kaolin) microstructure consisted of sapphirine and forsterite crystals embedded in a glass matrix free of porosity (Figure 1).

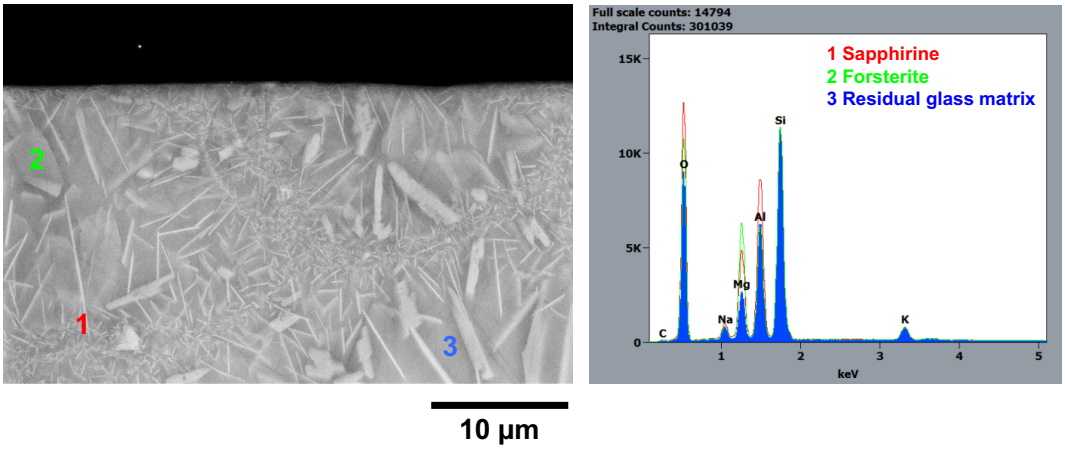


***Figure 1.*** *SEM–EDX of the selected frit.*

Different composites were prepared, using the following materials as filler: zircon and two aluminas, with different particle size distributions. The test pieces were fired at different maximum temperatures, at a heating rate of 15K/min and residence time at peak temperature of 6min. Inappropriate mixing (procedure 1) was verified to lead to a heterogeneous unfired and fired microstructure (presence of porous filler agglomerates). In contrast, appropriate mixture preparation (procedure 2) yielded a material with a homogeneous microstructure, with no open porosity and very low closed porosity (Figure 2).

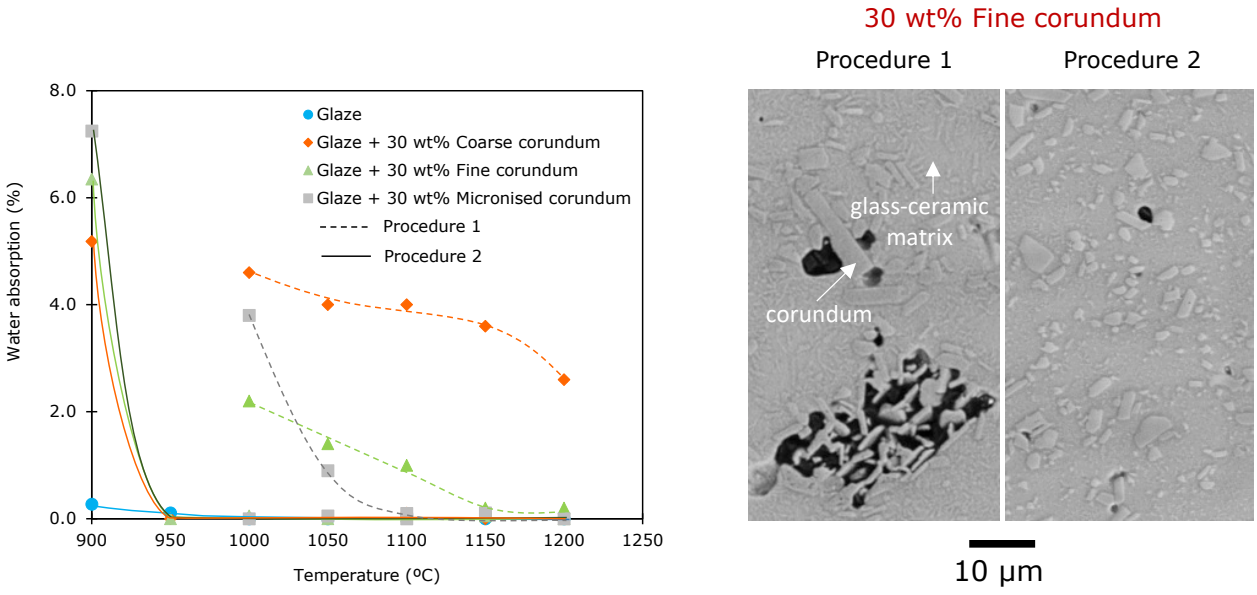


***Figure 2.*** *Effect of the mixing procedure on composite sintering and microstructure.*

In addition, procedure 2 enabled homogeneous composites, free of open porosity, with low closed porosity and high filler content, to be obtained (Figure 3).

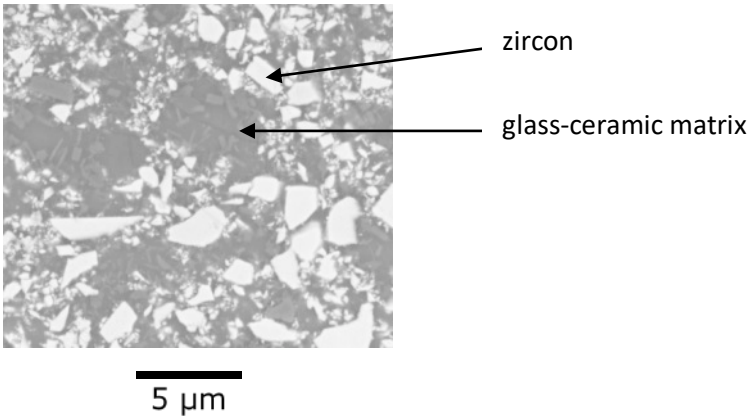


***Figure 3.*** *SEM micrograph of the composite with 55 wt% micronised zircon, at 1150ºC.*

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