



PROJECT "THEORY AND APPLICATIONS OF SINTER-CRYSTALLIZATION" DN 19/7

Quantification of Transient Quartz before and after sinterization

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Abstract:

The transition between α quartz and β quartz at 575°C involves a large volume expansion and causes a discontinuity in the thermal expansion of ceramics.

Industrial processes take into account this effect in the cooling phase, as residual stresses can develop between fast-cooling and slow-cooling portions of a ceramic products. Rapidly shrinking quartz crystals immersed in the ceramic matrix can rupture or detach, seeding microcracks and increasing brittleness.

This study presents the Quantity of Transient Quartz (Qtq) method for calculating an apparent volumetric concentration of quartz from the optical dilatometric expansion curve, which is related to the actual quantity of quartz contained in the ceramic body. The numerical technique decomposes the thermal expansion curve as the weighted sum of the characteristic non-linear thermal expansion of the pure quartz from the overall quadratic interpolation of ceramic body expansion between 475°C and 675°C.

Optical Dilatometer measurements on reference samples of pure quartz sand mixed with alumina powder are run in order to verify the method. The use of a contactless measurement technique is mandated by the incoherent nature of the powders. Qtq is then applied to a raw ceramic body with known pre-firing quartz content, which is fired in the Optical Dilatometer and then measured again to verify the effect of prolonged quartz exposure to the glassy phases on its apparent transient quantity.