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

Sintering kinetics, phase transformations and meltproperties during the vitrification path of the ceramic products.

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Abstract:

Thiscontribution was aimed at comparing the sintering kinectics, the evolution of phase composition and of non-crystalline matrix properties during the vitrification path of four representative industrial ceramic formulations (soft porcelain, vitreous china; three different batches of porcelain stoneware, including a glass-bearing one).These batches were prepared at the laboratory scale, simulating their industrial ceramic process. Both materials are designed with the same ingredients (e.g., kaolin, ball clay, feldspar, quartz) but in different ratios.The sintering kinetics of each sample was determined under isothermal conditions through an industrial-like firing schedule by optical thermo-dilatometric analysis. The investigated samples were treated up to a final temperature in the range between the temperature in which the viscous flow sintering starts (around 1000 °C) and the onset of the deformation (up to 1400 °C for porcelain) at increasing dwell time. The phase composition was assessed by Rietveld refinement and the chemical composition of the vitreous phase was obtained by subtracting the contribution of each mineralogical phase, considering its stoichiometric formula. The melt properties were estimated by predictive models based on the chemical composition of the liquid phase. An increasingly faster sintering kinetics was observed in the order: soft porcelain, vitreous china, porcelain stoneware, glass-bearing stoneware. Different vitrification paths were observed with a correlation between the dissolution kinetics of feldspar and quartz. Remarkable differences were observed in those samples where mullite occurred as primary or secondary mullite. Those differences clearly reflected on a distinctive evolution of chemical features and pseudo-structural parameters of the non-crystalline matrix.