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Tracing of the porosity variations with micro computed tomography during sinter-crystallization process

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Abstract: The variations of porosity during sintering and crystallization in a model glass is traced ex-situ by computed micro-tomography. This modern technique offers 3D imaging, coupled with morphometry analysis including evaluation of total, open and closed porosities, pore size and volume distribution, as well as interpore distance and distribution. These parameters were determined for a series of samples, which were heat-treated for different times (between 0 and 240 minutes) at temperature of 800 ºC. In the study pressed samples from glass fraction between 75 and 100 microns, forming at about 60 % diopside, are used.

The results show that at the end of the heating ramp the porosity is elevated and predominantly open. A rapid decrease of the total porosity, due entirely to the diminishing of the open porosity, follows. After at about 20 minutes at 800 ºC, when more intensive crystallization begins, a slow increase of closed porosity is observed while the residual open one remains constant. In parallel, the pore size decreases initially then increases again while the interpore distances change inversely – first increase and then decrease. These observations confirm the established earlier appearance of crystallization induced porosity, which is a result of the large density difference between crystal and amorphous structures of diopside.