

SINTERING, CRYSTALLIZATION AND FOAMING OF VITRIFIED METALLURGICAL SLAG

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ABSTRACT

Syntheses of sintered glass-ceramics and foams from glass, based on 70 wt % metallurgical slag is presented. The densification process takes place in the temperature range 800 – 950 oC, while at higher temperatures starts an intensive autocatalytic foaming. This bloating process is related to oxidation of the iron and manganese oxides, presented in the slag in the glass transition range and the subsequent oxygen release at higher temperatures due to their partial thermal reduction. However, if the heat-treatment is performed in inert atmosphere no oxidation and foaming are observed. As a result, by adjusting the atmosphere and the heat-treatment the synthesis of different materials is possible.

The kinetics of densification in air and argon atmospheres is evaluated by Hot Stage Microscopy (HSM) runs at different heating rates. The structures of sintered and foamed samples are observed with SEM and X-Ray computed tomography, respectively.

It is elucidated that in argon environment the sintering temperature is lower, the activation energy of sintering decreases and the foaming trend is completely inhibited. As a result, samples with better degree of sintering and porosity of only 6-7 vol % are obtained. Contrary, during a traditional heat-treatment in air the foaming rate increases with the temperature rise and samples with at about 90 % closed porosity can be obtained after 10-20 minutes at 1100- 1120 oC .

Keywords

metallurgical slag, sintering, foaming

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