

Eggshells as agro-industrial waste substitute for CaCO_3 in glass foams: A study on obtaining lower thermal conductivity

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Abstract

In this work, discarded glass bottles (GB) and eggshells (ES) were used to produce foam glass designed for thermal insulation. The literature on the thermal conductivity of foam glasses produced with eggshells is sparse. This material was used as pore-forming agent at 3% and 5% weight fractions to obtain a foam glass with low thermal conductivity. Homogenized powders were uniaxially pressed, and the compacts were fired at three temperatures (800, 850, and 900°C). Raw materials were characterized by chemical analysis and particle size distribution. The foam glasses were characterized by their porosity, phases, compressive strength, and thermal conductivity. The best insulating properties were obtained for the composition containing 5 wt% ES fired at 800°C. This sample displayed a porosity of 91.4% while its thermal conductivity was of 0.037 W/m.K, with a compressive strength of 1.12 ± 0.38 MPa. Crystalline phases were observed in samples fired at 850 and 900°C as a result of the devitrification process. The final properties of the materials are comparable to those of commercial foam glasses obtained from non-renewable, more expensive raw materials, a great indicator that the studied compositions could be used as an environmentally friendly substitute.

Keywords

Foam glasses, Foaming, Mechanical properties, Thermal conductivity