Effect of Macrostructure on Thermal Conductivity of Foam Glass

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Abstract

Cathode ray tube (CRT) panel glass can be recycled into foam glass. The foam glass is used as an insulating material for building constructions. Thermal conductivity is therefore a crucial property of the foam glass. Density has a major impact on the thermal conductivity [1,2]. At low densities, the cellular structure of insulation materials becomes important. For example, the conduction path through the solid matrix becomes longer or radiative heat transfer increases. The impact of the foam structure on the overall thermal conductivity of foam glass remains almost completely untouched. In this study, we prepared foam glasses from CRT panel glass using Mn3O4, carbon, and different content of K3PO4. All foam glasses are experimentally analyzed regarding foam density, porosity, and thermal conductivity. These data are compared to 3D structural data on wall thickness and pore size obtained from X-ray microtomography (XMT) analysis. The pore size distribution, average pore size, and wall thickness varies among the samples, though, neither increasing or decreasing pore size, nor narrowing or broadening size distribution is found in a consistent manner with varying K3PO4 content. Moreover, the wall thickness is found to have no significant influence on the porosity and thermal conductivity. However, the relation between average pore size and thermal conductivity indicates a correlation for foam glasses with porosities between 87–90 %.

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