Preparation of Microcellular Polystyrene Foams with Supercritical CO2 and Co-Solvent.

Topiař, Martin
2016

Preparation of microcellular polystyrene foams with supercritical CO_2 and co-solvent

M. Topiar, [1]A. Nistor, [1]Déborah de Masi, [1]J. Kosek
Institute of Chemical Process Fundamentals of the CAS, Rozvojova 135, 165 02 Prague 6, Czech Republic;
[1]University of Chemistry and Technology Prague, Dept. of Chemical Engineering, Technická 5, 166 28 Prague 6, Czech Republic;
tel. +420 220 443 296, fax: +420 220 444 320, e-mail: Juraj.Kosek@vscht.cz

Polystyrene (PS) foams are used for packaging and mainly as thermal insulators. PS microcellular foams have the potential to replace common commercial PS foams (with cell sizes above 100 μm) because they can offer improved thermal insulation properties [1, 2]. This improvement is reached by decreasing the cell size below 10 μm. Such microcellular foams can be prepared using supercritical CO_2 ($scCO_2$) as the blowing agent. However, the prepared microcellular foams often have an insufficient porosity that is lower than 90 %.

In this work, we use co-solvents to increase the foam porosity. Microcellular PS foams were prepared by the pressure induced foaming method using $scCO_2$ and various co-solvents. The foam morphology was characterized via SEM. The effect of co-solvents on the foam morphology was the following: the use of co-solvents caused an increase in porosity by the occurrence of larger cells and the formation of interconnected cells, which made the morphology less homogeneous. But at higher co-solvent concentrations (e.g., > 6 wt.%, at 70°C) the morphology became homogeneous and a very high porosity was reached (Figure 1). Additionally, the use of co-solvents enabled us to prepare homogenous microcellular PS foams at lower impregnation temperatures, which has not been possible before just with the use of $scCO_2$.

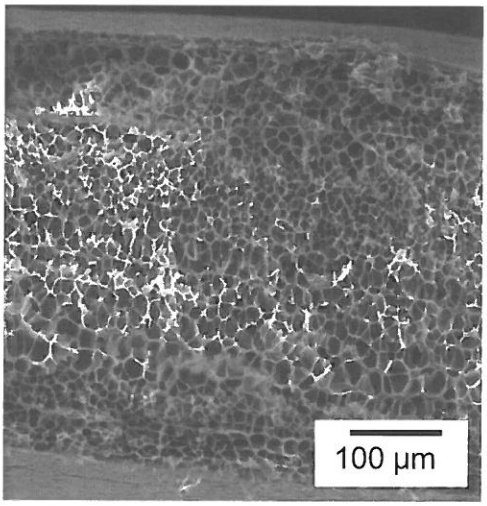

Figure 1: Cross-section cut of a microcellular PS foam.

References:

1. Ferkl, P., R. Pokorny, M. Bobak, and J. Kosek, *Heat transfer in one-dimensional micro- and nano-cellular foams.* Chemical Engineering Science, 2013. **97**: p. 50-58.
2. Notario, B., J. Pinto, E. Solorzano, J.A. de Saja, M. Dumon, and M.A. Rodríguez-Pérez, *Experimental validation of the Knudsen effect in nanocellular polymeric foams.* Polymer, 2015. **56**: p. 57-67.