Tailoring the Morphology of Microcellular Polymer Foams

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TAILORING THE MORPHOLOGY OF MICROCELLULAR POLYMER FOAMS

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In this work, we focus on polymer foams with improved heat and/or sound insulation properties, in particular on microcellular foams with the cell sizes below 10 µm. By decreasing the cell size below 10 µm or even lower we can highly improve the foam heat and sound insulation properties [1, 2]. Depending on the foam structure (open-, closed-cell or dentritic) the foam application can vary. The structure-property relation is thus of great interest as well as the preparation of foams with various morphologies and scale-up of the manufacturing of microcellular foams.

We prepared polystyrene microcellular foams (i) via pressure induced foaming (PIF) using supercritical CO_2 as the blowing agent and (ii) via thermally induced phase separation (TIPS) using cyclohexane or cyclohexanol as the solvent (**Figure 1**). The cell size distribution, porosity and the open cell fraction in the foams were affected by the foaming conditions. We observed that the T_g and solvent residua have a significant impact on the foams prepared by PIF [3]. We found three types of morphologies that can be prepared by TIPS: 1) loosely aggregated particles, 2) co-continuous pore/solid structures and 3) partially closed cells. Moreover, on the case of polyurethane foams we demonstrate the tools developed for the automatic morphology characterization.

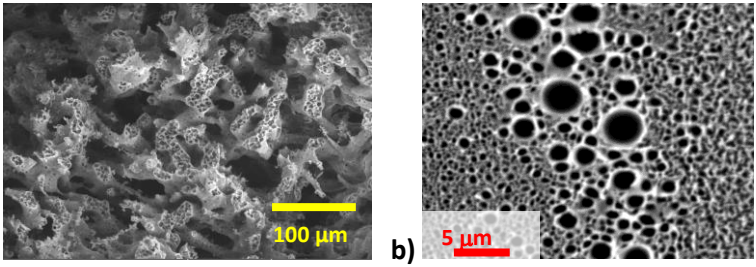

Figure 1: Examples of foam morphologies: a) co-continuous pore/solid structure prepared by TIPS and b) closed-cell foam prepared by PIF.

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