On how the Morphology affects Water Release of Porous Polystyrene

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ABSTRACT

Expanded polystyrene (EPS) foams are widely used materials that find application in a broad variety of fields. A typical blowing agent for the expansion of polystyrene is pentane. However, the use of pentane entails several drawbacks such as a high flammability. For that reason, it is crucial to find an alternative blowing agent that is both safe to use and environmentally friendly. Water could meet these demands but, in contrast to pentane, it is immiscible with both styrene and polystyrene. However, it is well known that water droplets can be incorporated into a polystyrene matrix via polymerization of water-in-styrene emulsions [1]. In previous studies, the use of w/o-emulsion templates for the preparation of water expandable polystyrene (WEPS) beads was already reported [2,3]. However, the desired expandabilities of WEPS have not yet been achieved. What the preceding studies had in common was that w/o-emulsion templates with low water volume fractions were used. For this reason, our aim was to incorporate as much water, i.e. blowing agent, as possible into polystyrene. To tackle this, water-in-styrene high internal phase emulsions (HIPEs) with water volume fractions of 70 % and more were used as templates for the synthesis of highly water-loaded polystyrene. In order to find an optimum system for the subsequent preparation of WEPS beads, we varied the water-in-styrene HIPE composition systematically and determined the properties – especially the morphology – of the resulting polymerized w/o-HIPES (polyHIPEs). PolyHIPE monoliths were used as easily accessible model systems for initial studies between morphology and the water release from polyHIPE monoliths.

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