

PHYSICAL FOAMING OF A SILICONE RESIN WITH CARBON DIOXIDE

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Foams of crosslinked silicone resins are of interest from two points of view. Firstly, they possess some properties superior to common organic polymer foams. Beyond good mechanical properties, high temperature stability, and good chemical and weathering resistance, they are inherently not inflammable. Secondly, silicone resins are interesting for the use as ceramic precursors since they belong to the class of preceramic polymers.

In its initial state the silicone resin investigated shows a thermoplastic behaviour. Therefore, well established processing techniques like extrusion together with physical foaming can be applied for shaping preceramic polymers foams. Before the silicone resin is transformed into ceramics by pyrolysis the shaped foam has to be stabilised by a crosslinking process. This can be done during or after the shaping step.

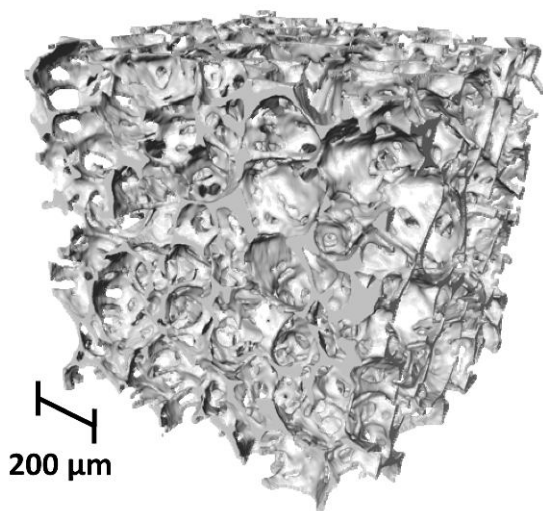


Fig. 1 3D computed tomography image of a sample foamed at 45°C and 152 bar in the batch process (Courtesy of T. Fey, University Erlangen-Nürnberg)

As a pre-study for extrusion foaming the silicone resin was investigated in a batch process. Fig. 1 depicts a 3D computed tomography image of a sample foamed at 45°C and 152 bar. The batch process is well suited to determine the influence of processing and material parameters on a small scale. While the temperature mainly influences the porosity, the average cell size can be varied between 100 μm and 350 μm by controlling the pressure drop during foaming. It is interesting that the cell morphology can be shifted from an open to a closed structure by a moderate crosslinking of the silicone resin applying a heat treatment prior to foaming.

In order to obtain foams on a larger scale a continuous foam extrusion line for silicone resins was set up. Thus, long foamed strands with various cell characteristics can be obtained depending on the processing parameters applied.