Production of Microcellular Foam Plastics by Supercritical Carbon Dioxide

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A batch process for the production of microcellular plastic was studied in the systems: polymethylmetacrylate (PMMA) -supercritical carbon dioxide and the polycarbonate (PC) - supercritical carbon dioxide. The samples of polymer sheet, with thicknesses of about 3 mm (PMMA) and 4 mm (PC), were cut into 0.7 x 3 cm pieces. The pieces were put in the saturation vessel of which the temperature and pressure were kept constant. Supercritical carbon dioxide at the temperature range from 303 to 393 K and the pressure range from 100 to 250 bar was used as the foaming agent with PMMA and PC. After the saturation of carbon dioxide in the PMMA and PC polymer samples, the pressure was quickly released to atmospheric pressure. The samples were immediately taken out from the vessel and heated in a silicon oil bath at a foaming temperature for some time during heating, and then immersed in ice water. The fractured part of the samples was used for microstructure analysis with SEM.

The effect of the saturation temperature, pressure of carbon dioxide sorption, and foaming time on the average cell size, cell density, and bulk density of microcellular PMMA and PC were investigated by considering the solubility of the gas in the plastics. The solubility of carbon dioxide, which was related to the saturation temperature and pressure, was effected considerably by the cellular morphology of the plastics. The cell density increased and, consequently, the cell size decreased with the increased solubility of carbon dioxide. The foaming time could be used a controlling factor to obtain the desired foam structure and volume expansion ratio.