

Memory Effect in Porous Polyethylene Films Preliminarily Deformed in the Medium of Supercritical CO₂

Monday, 24 October 2022 17:20 (15 minutes)

The dynamics of recovery of the open porous structure in HDPE films, which are preliminarily uniaxially deformed in the medium of supercritical CO₂ followed by shrinkage in the longitudinal direction, upon their repeated stretching in air is studied by structural mechanical methods. The process of shrinkage is accompanied by the approach of lamellas and the disappearance of the oriented fibrillar structure. The value of relative shrinkage may be as high as 70–80%. According to atomic force microscopy and small-angle X-ray scattering, these polymer films “remember” their previous strain in CO₂ and in their repeated stretching in air, which is not a physically active medium, and restore the fibrillar porous structure of crazes with similar parameters. The phenomenon of such a memory makes it possible to use PE films preliminarily formed by the mechanism of intercrystallite crazing followed by their subsequent relaxation in the freestanding state as “precursors” for producing mesoporous materials with the pore volume on the order of 30 vol % for application in various fields, in particular, as vapor permeable membranes.

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Session Classification: Applied Research

Track Classification: Applied Research