THROUGH PERMEABILITY OF POLYVINYLIDEN FLUORIDE POROUS FILMS

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The aim of this work was to elaborate a «dry» method (without any solvents and admixtures) to prepare the permeable porous PVDF films containing through flow channels. PVDF commercial grades (Kynar, USA) (M_w=1.9·10^5) were used for the films preparation. The samples have been obtained in the five-stage process: melt extrusion at spin draw ratios (λ) from 15 to 157 (1); isometric annealing at fixed ends of the film at temperature close to the melting point (170°C for 1 hour) (2); room-temperature uniaxial extension up to elongation 40% (3); high-temperature uniaxial extension at 100°C up to elongation 50% (4) and thermal fixation under isometric conditions during 1 h at temperature 100°C (5). Pore formation was observed at the 3d and 4th stages of the process. The overall porosity (P) of the films was found to grow with λ increasing. It was proved by filtration porosimetry (ethanol) that the porous structure comes up to the percolation threshold for the through pores appearance at λ=84 and P=30%. The films prepared at λ≥84 are characterized by the values of through permeability 1.4-1.8 l/(m^2·h·atm). Specific surface of the permeable samples was 37 m^2/g and pore sizes were in the range 12 – 30 nm (method BET of nitrogen desorption). It was shown by scanning electron microscopy that the permeable porous films have a very homogeneous porous structure, and they are characterized by strongly developed relief-like surface. It was demonstrated by SAXS and WAXS that these films contain the crystals of α- and polar piezoactive β-modifications. At increasing of λ the content of α-crystals increases and β-crystals decreases. Orientation initiates as polymorphic α→β transition as pore formation, and at λ≥84 the last process prevent the crystal structure transformation.

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