Homopolymers consisting of crystalline and possibly amorphous parts can be transferred to microporous products. A homopolymer, like polyethylene for instance, is treated with a swelling agent like perchloroethylene. Then the foil is stretched and the swelling agent removed [3, 20]. Homopolymers like polypropylene or polytetrafluoroethylene (PTFE) (9.3 [11]) are in a crystalline state at room temperature. If films are stretched a kind of mini-crack occurs, which remain as micropores. Polymers with a partial crystalline structure such as polyolefins, polyacetates or polyamides become microporous by stretching [21].

The same technique can be used to produce microporous fibers. Prior to spinning, calcium carbonate is incorporated into polypropylene. During the spinning, the fibers are stretched to five times their original length [17]. The microporosity of the fibers may be further increased by leaching of the calcium carbonate with a methanol solution of hydrochloric acid.

The stretching of homopolymers can be carried out by stretching of films in a biaxial way. Gore-Tex® (trademark of W.L. Gore and Ass.) is a stretched, microporous polytetrafluoroethylene (PTFE) (Fig. 16-1) [1, 2].

Naphtha and PTFE are extruded to foils. Naphtha is evaporated at 100°C and the foils are additionally heated at <350°C. These foils, consisting of microporous PTFE, can be laminated with adhesives, based on hydrophilic polyurethanes (21.2 [13], [4–7, 11]), onto textile substrates. A unit to do this on a technical scale has been described [8]. As hydrophilic polyurethanes, isocyanate prepolymer, able to react with water or crosslinkers based on diamine carbonate, are also suited [9, 10].

Microporous products produced by stretching can be used in the production of shoes [15, 16]. The microporous PTFE films are usually laminated on a textile by means of a hydrophilic polyurethane. Additionally, the microporous PTFE film may also be filled by a hydrophilic polyurethane [23].

Films consisting of polyethylene are stretched in one direction. Then a liquid filling agent is applied to the surface of the stretched film. The filler should enter the pores; then the film is stretched again in a second direction and the liquid filler is hardened by heat. The product is suited for the production of protective clothing or as a separating agent for batteries [18]. Polyethylene containing other polymers, like PTFE or polyamide-6, where the melting range should be lower than that of the polyethylene, is extruded to a film and stretched to become microporous [19].
Isotactic polypropylene or a statistically polymerized C₄–C₁₀ α-olefin can be formed to a film, etc. by slush molding. The resulting products can be used as indoor panels for automotives [14].

Stretched microporous polyethylene films are printed with an isocyanate prepolymer, dissolved in butan-2-one so that then the solution enters the pores of the stretched polymer. After evaporation of the solvent, the resulting microporous film can be adhered to fabrics, which can be used in the production of gloves or wound dressings [12].

Water-repellent or hydrophobic stretched, microporous polymers are produced with fluorine-containing products like FREON® (DuPont) [13].

Nonwovens may be impregnated with a dissolved thermoplastic material like chlorinated polyethylene or vinylidene chloride–acrylonitrile copolymers. After the evaporation of the solvent the material is stretched to become microporous [22].

16.1 Mixtures of Incompatible Polymers

As homopolymers with crystalline segments mixtures of – preferably – incompatible polymers can also be used to create microporosity by stretching of films produced from them [1]. The only requirement is that the polymers are miscible at an adequate temperature. Polymers which are soluble with each other at