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THERMOMECHANICAL SIMULATION OF PET STRETCH/BLOW MOLDING

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In the stretch-blow molding process of Poly(Ethylene Terephtalate) bottles, a tube-shaped preform is heated above the glass transition temperature and then inflated with plug assistance to obtain desired bottle shape.

The performance of PET bottles produced by the stretch/blow molding process is determined both by operating conditions and by material properties (1).

The initial temperature of the preform is generally non uniform. Important temperature gradients arise during the inflation process at the contact point between the plug and the parison and along the neck of the bottle.

An incremental finite element technique based upon a volume approach is used to describe the inflation process.

At each time step a decoupled technique is used to solve mass and force balance equations and the differential viscoelastic constitutive equation (2). A thermal balance equation taking into account viscous dissipation as well as heat transfer with the mold wall and the surrounding air is then solved.

A carefull remeshing procedure as well as time step adaptivity are introduced.

Fig. 1 shows intermediate shapes from the initial preform to the final bottle which were obtained using the Oldroyd B constitutive equation. On the right-hand side we have nonisothermal calculations, and on the left-hand part isothermal calculations. In Fig. 2, the influence of thermal effects on the stretching force is shown. In Fig. 3, temperature distribution is shown at the bottom of the bottle.

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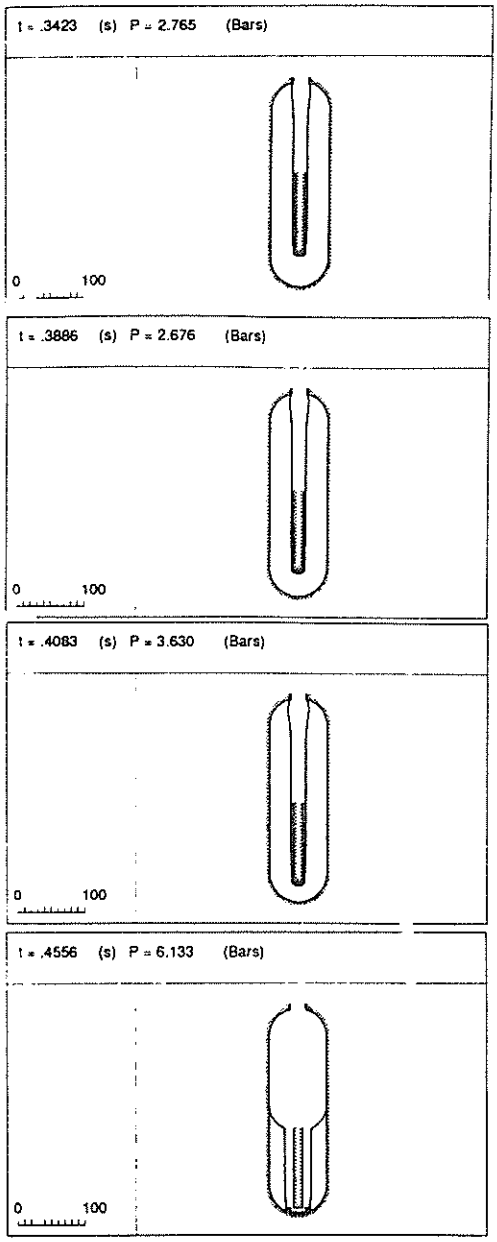
Fig. 1 Intermediate bottle shapes



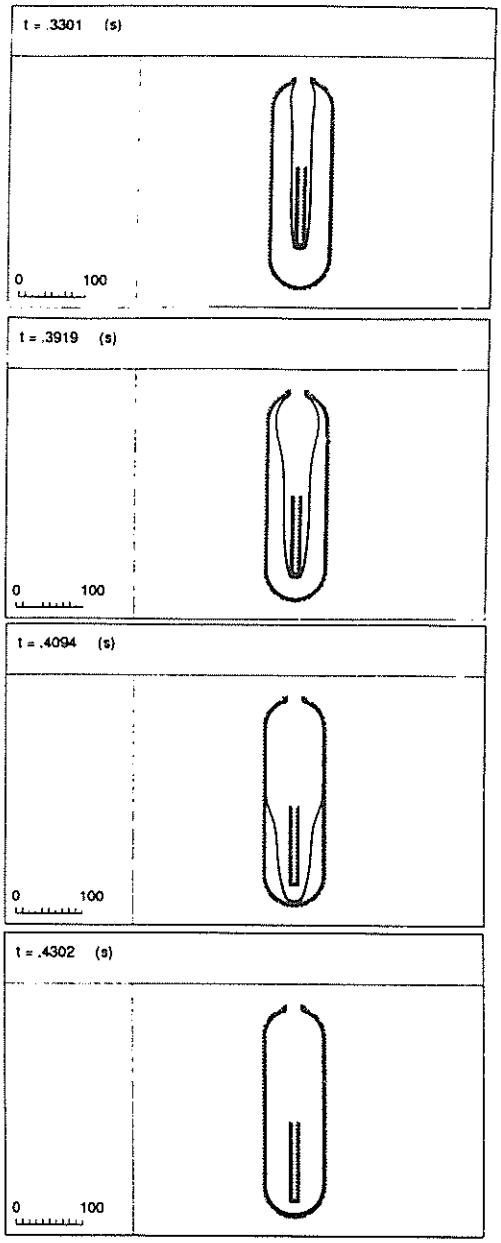


Fig. 2 - Stretching Force Versus Time

Fig. 3 Temperature distribution