Thermoforming represents a cost and resource efficient method for the production of plastic parts. To ensure an economic production a high degree of process stability is necessary. The basis for this is an exact material characterization/selection, advanced machine technology as well as their optimum interaction. The current works at Fraunhofer AVV focus on the analysis, description and optimization of machine-technical solutions.

### Specification of the thermoformability of polymers and plastics

A detailed specification of the thermoformability is a basic condition for choice, development and control of thermoform materials, processes and arrangements.

However, no general and industrially applicable testing method exists in spite of intensive research up to the present day for quantification of the thermoformability of thermo plastics.

Outgoing from an already finished project at Fraunhofer AVV the thermoformability is described with the help of thermoform test stands on example forms. Based on thermoform experiments forming parameters (temperature, time etc.), achievable forming depth and wall-thickness-distribution (WTD) are recorded and analyzed. So it is possible to make statements to the formability of materials in the context of service and research. Nevertheless, a form part specific statement is only restricted possible.
In a planned research project the specification of the thermoformability occurs through a huge number of optical, functional and forming specific criteria which are valued individually by means of simple replacement experiments. This approach allows the qualitative assessment of thermoplastic materials in terms of their thermoformability derived from the requirements of the final product.

**Technology development**

Beside the optimization of process parameters the test of new technologies and procedures is made at the thermoform test stand. Besides, the knowledge derived from the experiments is the base for the development of measuring systems for inline and random check of formed parts.

**Process simulation and material characterisation**

An efficient method for designing as well as optimization of the thermoform process represents simulation using FEM. Besides, base for a successful use by industry is a comprehensive modelling of the process as well as the material qualities. In the focus of the work are the characterization and modelling of the package material behaviour, simulation-based optimization of process parameters and studies and also their influence on the process.

**Test and measurement equipment**

- Thermoform test stands for process near experiments:
  - capturing of form process (inline)
  - capturing of form depth (inline)
  - defined influence of form air flow and temperature
  - forming of defined temperature fields on the initial material for defined influencing of WDT
  - integrated capturing of temperature fields by high-speed thermography system
- thickness measuring device MagnaMike (detection of WDT)
- thickness measuring device with optical coherence technology (detection of WDT – resolution of individual layers of composite materials)

**Your benefits**

Fraunhofer AVV offers a wide range of experiences to examine the thermoform process. The testing facilities allow process near and reproducible simulation of the thermoform process. So it is possible to analyse and develop the thermoform process into maximum stability and reliability. Beside the optimisation of process parameters to ensure the quality of form parts, the measurement and test technologies of Fraunhofer AVV offer an optimum base for the development and implementation of innovative technologies and procedures for thermoforming.