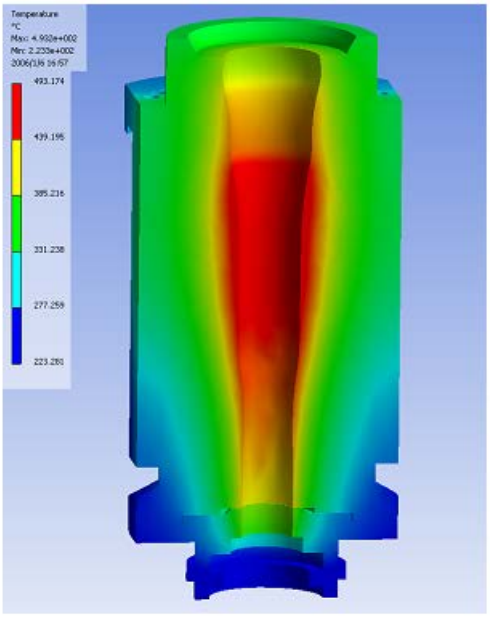
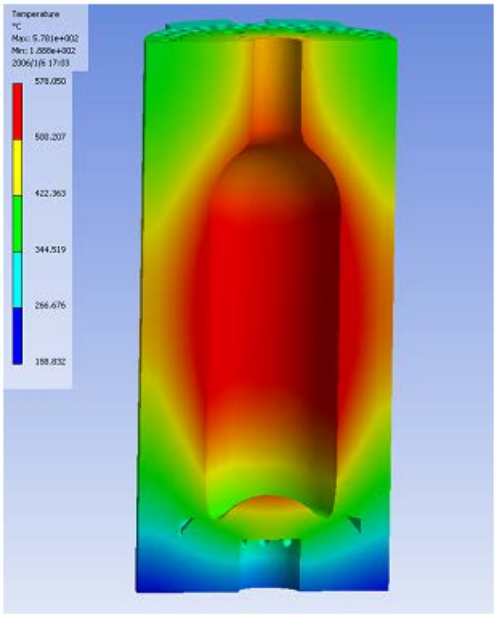
BUCHER
emhart glass

Technical News Bulletin

Steinhausen, July 2007





Cooling optimization service using advanced Mold Cooling Simulation Software

- Full 3D blank or blow mold simulation
- Predicts the temperature profile based on the planned mold design.
- Identifies thermal limitations and can give recommendations to resolve them.

Introduction

In 1989 Emhart Glass pioneered the introduction of “Vertitherm” the first software on the market to predict the temperature in molds. This software at the time was unique and represented a big technological advance; however it was limited to axis-symmetric molds on the blow-side only. In the meantime consumers were becoming more responsive to a greater variety of packaging designs challenging the glass producers to produce more complex shapes.

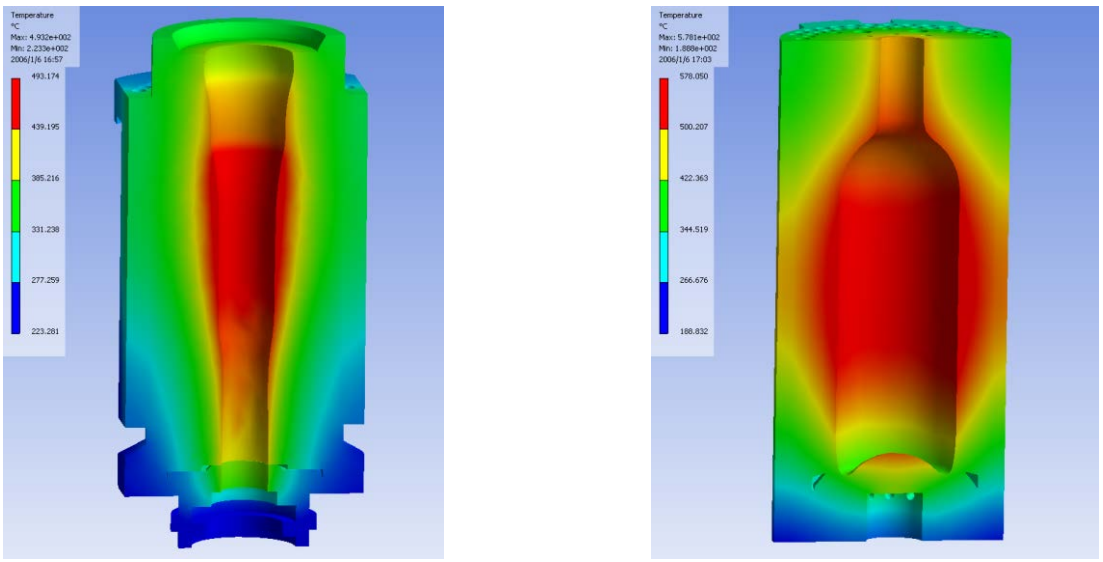


Figure 1 shows an example of a calculated blank mold (left) and blow mold (right) profile

A more powerful calculation tool was needed. The answer of Emhart Glass is the software called TekPak. TekPak significantly advances the process of mold cooling simulation allowing to produce **full 3D** mold temperature profiles irrespective of the complexity of the mold and container shape. TekPak is applicable, for both, **blank or blow side,** using all forming processes (PB-BB-NNPB). It uses state of the art CAD systems and FEM codes. As not every Glass plant has these tools and the resources to operate them available, Emhart Glass offers the calculation of the temperature profile on the mold as a service.

The determination of a thermal profile helps to

- Optimize the cooling hole pattern
- Optimize the temperature profile
- Understand production problems

Used calculation principle

TekPak is designed to work hand in hand with state of the art 3D CAD and Finite Element systems. The starting point is the actual or planned design of the mold. Based on the design data such as hole configuration machine speed and timing TekPak will then determine the specific mathematical boundary conditions needed to proceed. In the next step the 3D model created with an appropriate CAD tool is transferred to the FEA solver. Once the geometrical model is available in the FEA solver, the boundary conditions generated by TekPak are entered. Once this has been completed, the FEA solver calculates the temperature distribution.

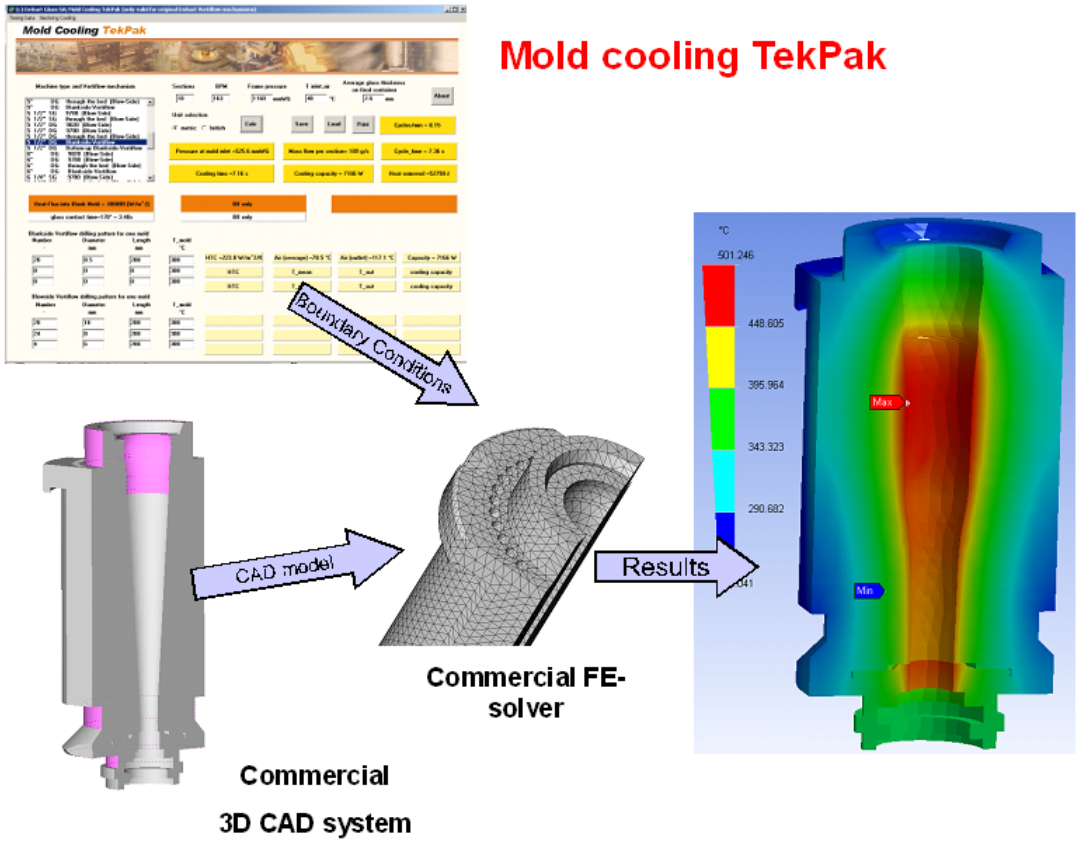


Figure 2 graphically illustrates how TekPak is applied

Requirements

By nature of the calculation process the following information must be available to produce a thermal simulation.

- Existing or planned cavity and cooling bore pattern design
- Process timing
- Forming machine type and number of sections
- Machine speed
- Cooling wind pressure in the section frame
- Estimate of inlet air temperature
- Average container wall thickness (for blow side calculations only)

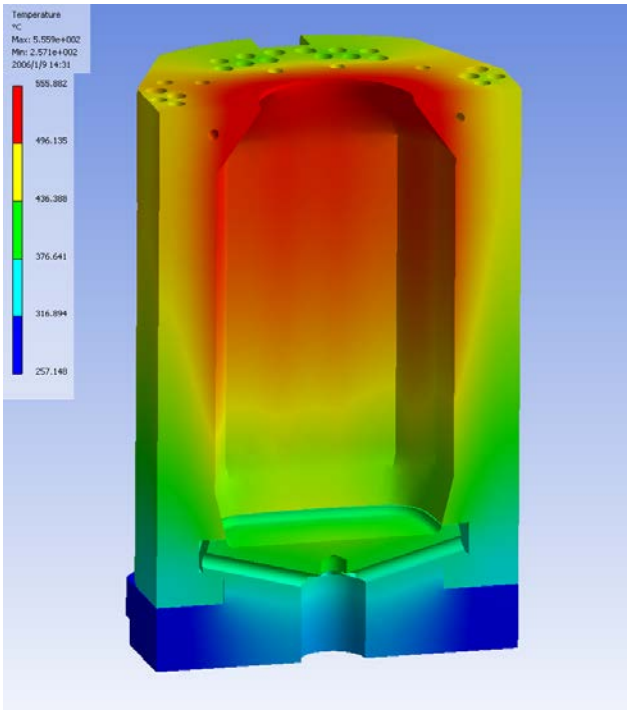


Figure 3 shows simulated temperature profile in a rectangular sectioned Jar

Delivered results

Based on the above mentioned inputs a report will be provided that includes

- A 3D temperature distribution of the blank or blow mold surface including details of the cavity temperature profile
- Horizontal temperature profiles at different mold heights
- A discussion of the profile and if applicable recommendations to optimize the distribution or the cooling capacity
- Mass flow through the mechanism

Features / Benefits

Today a controlled and predictable mold temperature distribution is an essential requirement for the production of quality glass containers. Using the cooling optimization service it is possible to create these conditions and more:

Features	Benefits
Full 3D blank or blow mold simulation	Insight of the thermal process
Predicts the temperature profile based on the planned mold design	Eliminates requirement for expensive trials
Determines if production problems caused by thermal conditions	Identification and pre-elimination of fault conditions
Predicts conditions for homogenous cooling	Pack increase (less forming faults)
Determines the mass flow through the mechanism depending on the hole configuration	Allows to estimate necessary cooling fan power for investigated container
Identifies thermal limitations and can give recommendations to resolve them	Potential production speed increase