Ansys

CASE STUDY /

Ansys + Whirlpool of India

"Using Ansys Polyflow® for thermoforming simulation helps us to solve a major challenge for the manufacturing team regarding liner thickness prediction in the thermoforming process."

Dr. Biswadip Shome
Director, Simulation Based Design / Whirlpool of India Ltd.

CASE STUDY

Thermoforming is widely used for mass production of refrigerator liners. Liner thickness distribution variation is an important quality parameter, which has been traditionally controlled by trial and error. This typically involves choosing different input sheet thicknesses and process parameters (temperature, pressure, etc.), which wastes material and manufacturing time. A thermoforming simulation could predict liner thickness and its distribution quickly and efficiently, eliminating such waste.

Refrigerator Liner Thermoforming Simulation for Thickness Prediction Using Ansys Polyflow

/ Company Description

Whirlpool is the world's leading global manufacturer of home appliances with $21 billion of 2016 sales while operating in nearly every country around the world. Focusing on consumer needs, fuels our growth and keeps us relevant in homes around the world. We exist to create purposeful innovation that helps keep homes running smoothly so personal and family lives can flourish.

/ Challenges

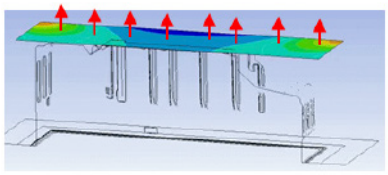
Thermoforming simulation is a problem of estimating viscosity and strain coupled with heat transfer and contact algorithms under governing equations of conservation of mass and momentum. Preparing a robust finite element model, incorporating comprehensive material modeling and mapping actual production environment conditions to quantifiable loads and boundary conditions are major challenges. Other hurdles include incorporating fluid-to-mold contact and release algorithms, along with conjugate heat transfer across contact surfaces.

/ Technology Used

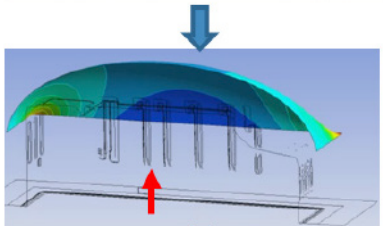
- Ansys Polyflow®

/ Engineering Solution

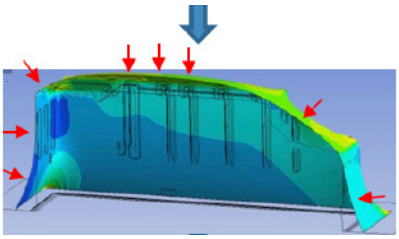
- Ansys Polyflow offers different equations to model the strain rate and temperature dependence of viscosity.
- Ansys Polyflow offers various material models and contact algorithms to effectively replicate the thermoforming process and predict accurate outcomes.
- The adaptive mesher of Polyflow helps to refine the sheet mesh when it comes in contact with the mold to closely follow mold geometry.



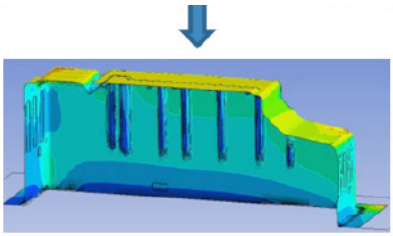
Stage 1: Application of Inflation Pressure.



Stage 2: Application of Mold Velocity.



Stage 3: Application of Vacuum between Sheet and Mold.



Thermoformed Liner.

/ Benefits

- Thermoforming simulation helps to solve a major challenge of thickness prediction for the manufacturing team, replacing the traditional time-consuming, trial-and-error process of tool builds and rework.
- Simulation reduces cost and time for the company by optimally selecting the sheet thickness, setting the operating parameters and testing the liner geometry before final tool builds.
- Using simulation, the liner can be rigorously designed for thermoforming (DFM).

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