Moldex3D

PU Chemical Foaming

EMEA
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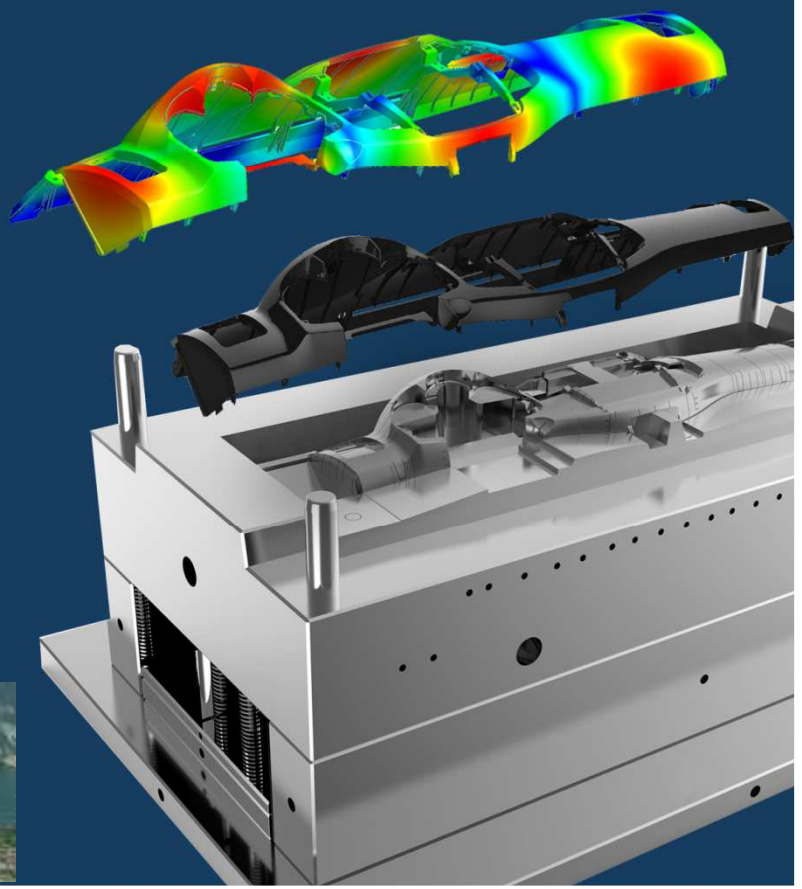
Moldex3D



PU Foaming

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Challenges in the Foaming Process

Moldex3D

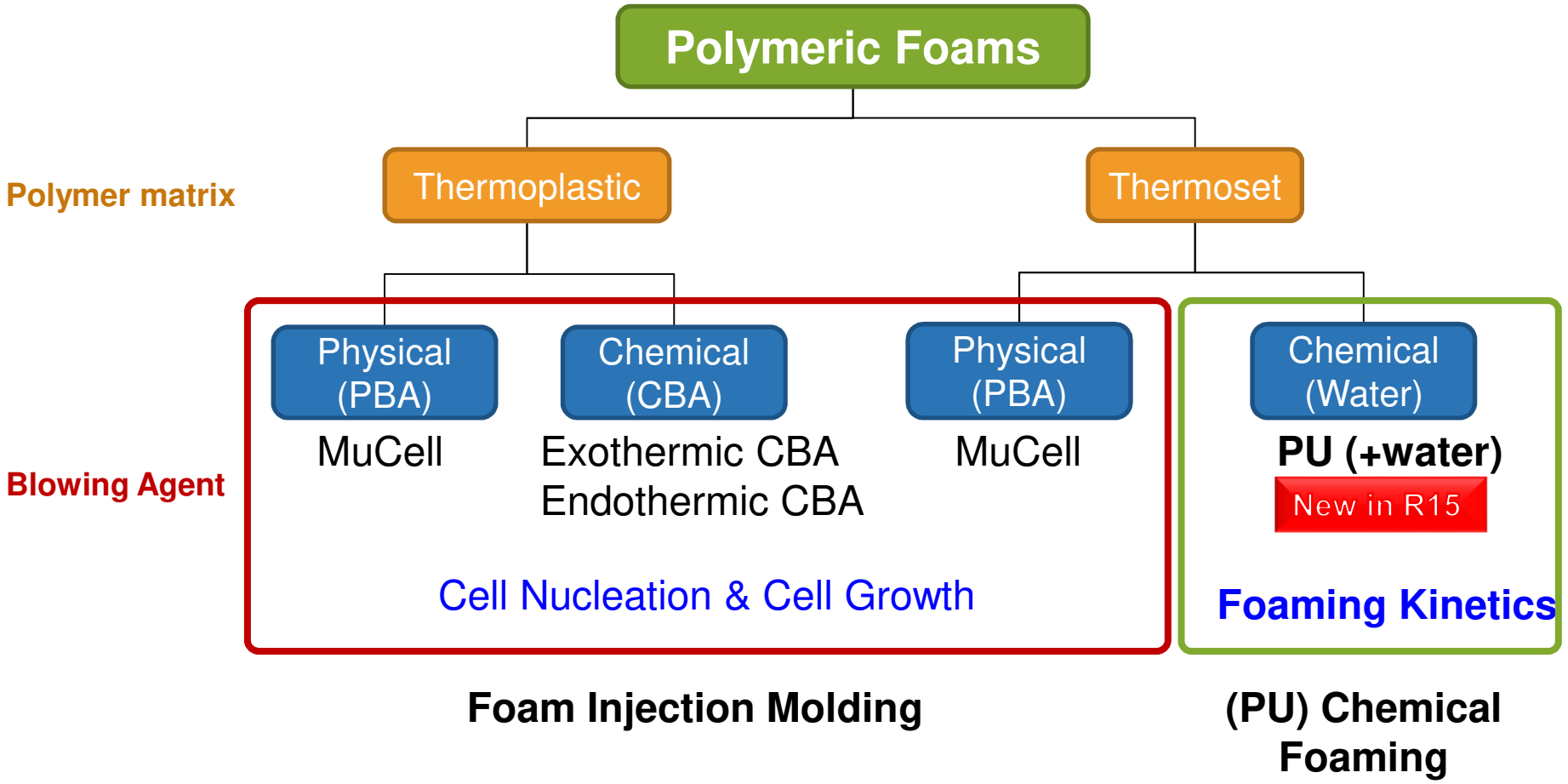
> **Difficulty of processing control**
> **(control of state of thermodynamic instability)**

> **Unknown status in a foaming process**
> **(temperature and pressure variation)**

> **Part defects**
  - **Lack of material**
  - **Bubbles**
  - **Aspect defects**
  - **Dimensional defects**

> **Development of reliable CAE technology**

Category of Polymeric Foams



What Moldex3D PU Chemical Foaming can Do

> Support Polyurethane(PU) foaming process simulation

> Assumptions
- Curing Kinetics
- Foaming Kinetics

> Results
- Curing conversion rate / Foaming conversion rate
- Cell size / Cell Density (New in R16)

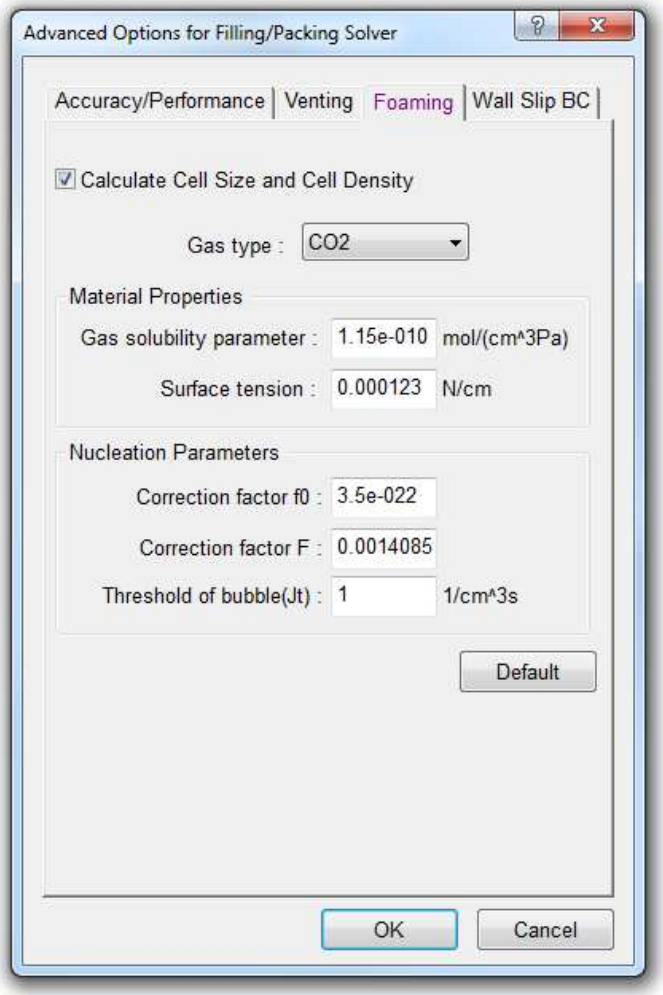
> Special Process
- Support oscillating rotation (New in R16)

> Only support Solid mesh file

Computation Parameters

> Calculate cell size and density

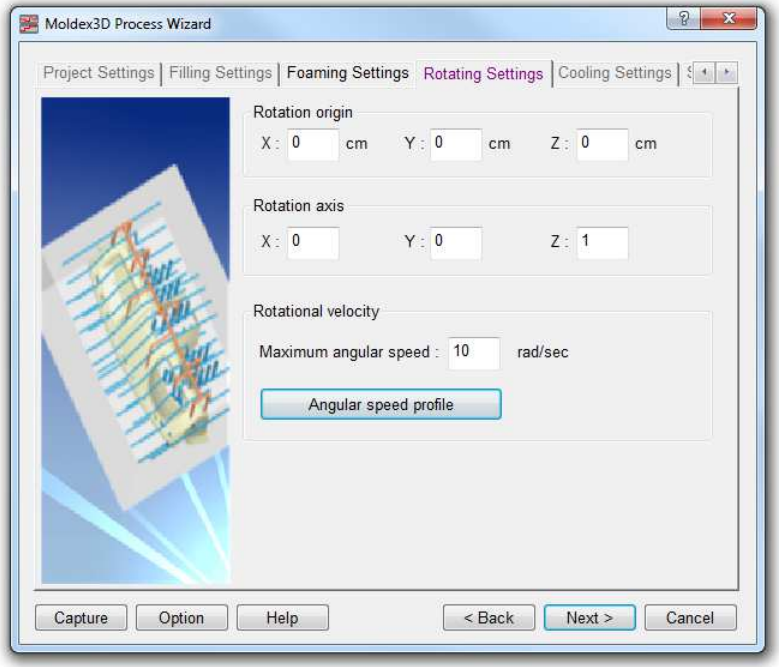
- Build-in gas type
  - N_2
  - CO_2
- Others
  - Further information needed

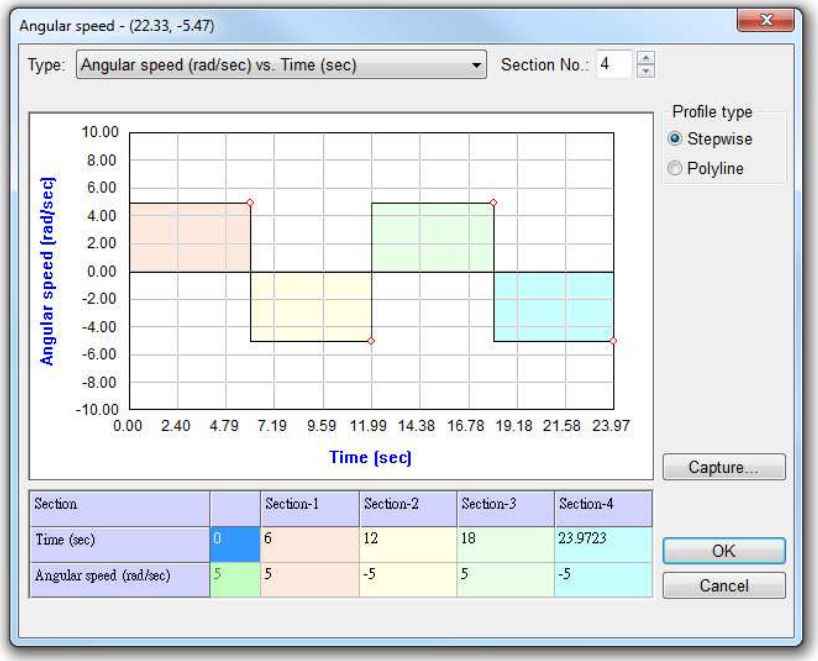


Process setting

> Rotating setting

- **Rotation origin and rotation axis**
- **Angular speed profile**





PU Kinetics Measurements

> Records the parameters of the foam's creation process with use of proper measurement tools

- Measurement of reaction temperature
- Measurement of pressure
- Measurement of profile of foam growth (foaming kinetics)
- Determination of viscosity level (foaming viscosity)
- Measurement of dielectric polarization (curing kinetics)

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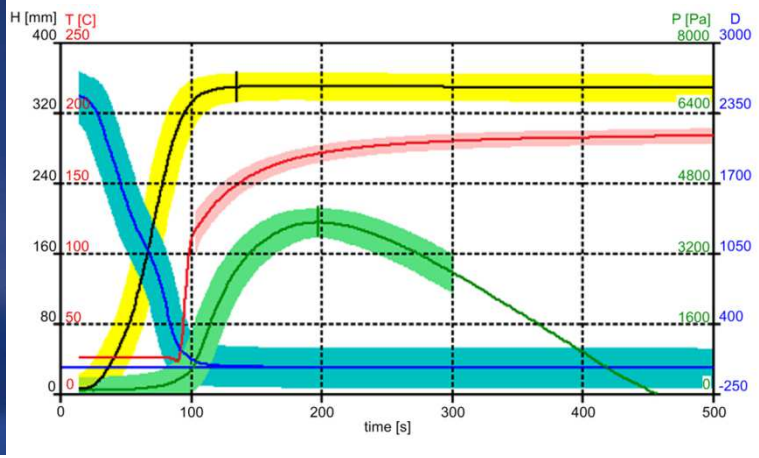
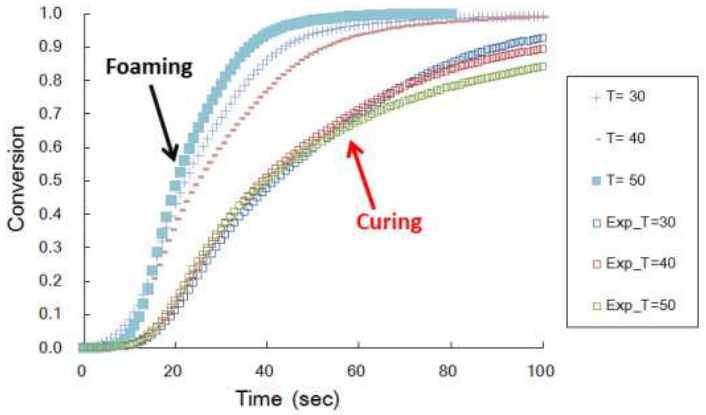
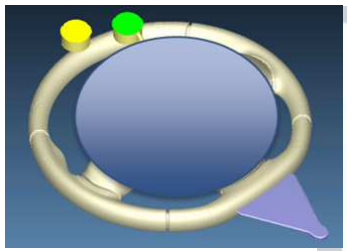
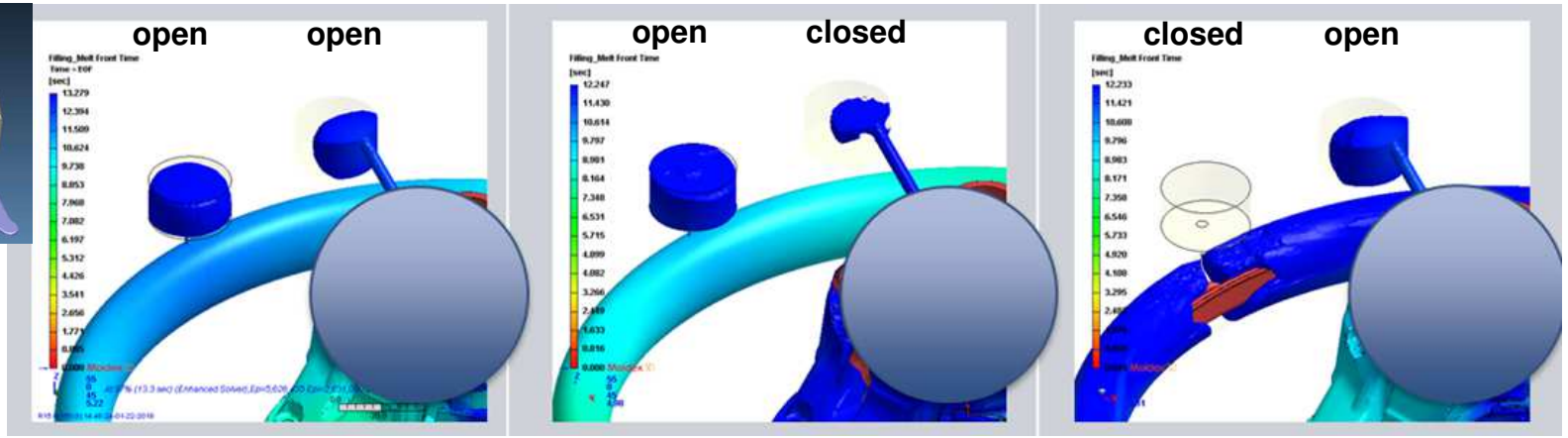


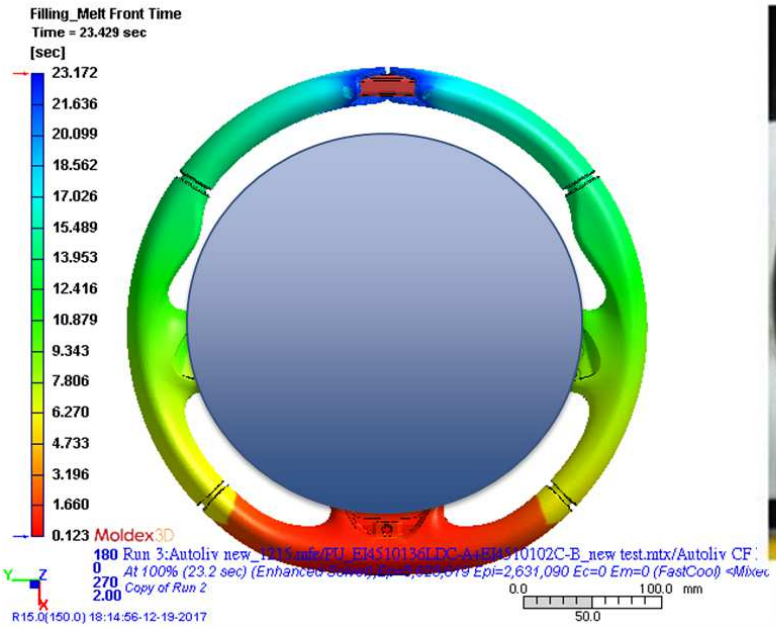


Chemical Foaming Example: PU Foaming

2 venting into overflow



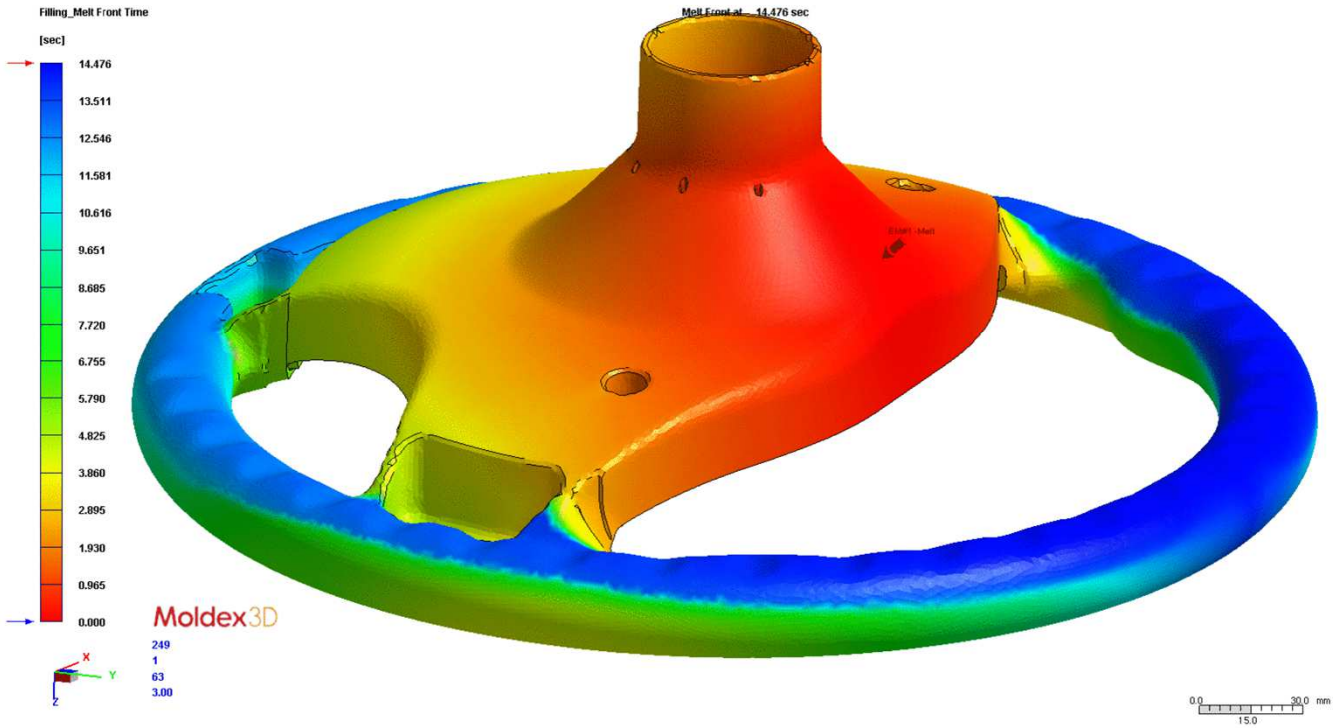




Simulated flow pattern matches reality, further used in performing a weight reduction analysis on the part, runner and overflow

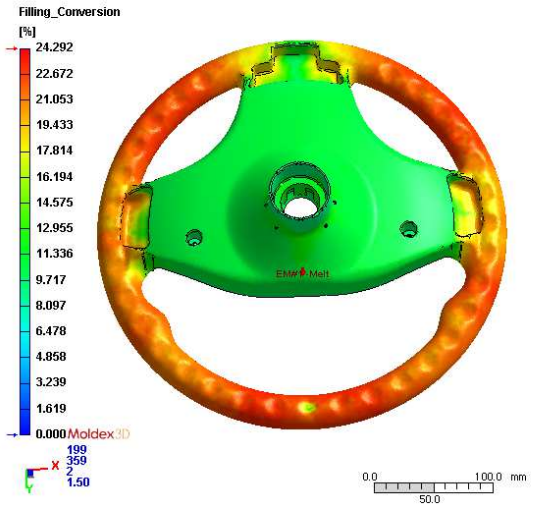
Analysis Output

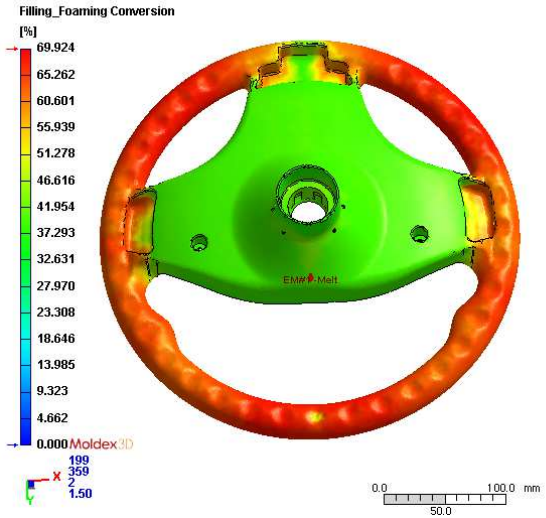
> **Melt front time**

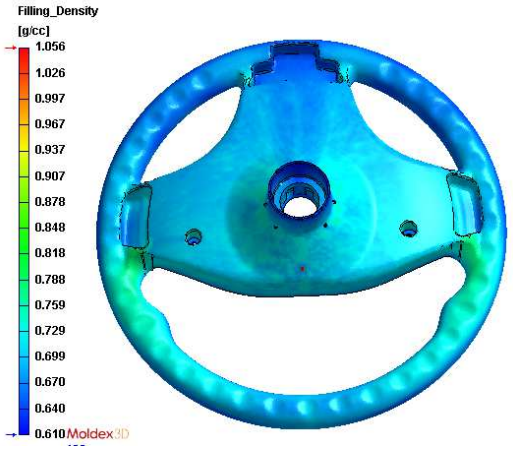


Analysis Output

- Conversion
  - Degree of curing/crosslinking
- Foaming Conversion
  - Degree of foaming reaction
- Density
  - Density distribution considering the foaming cells

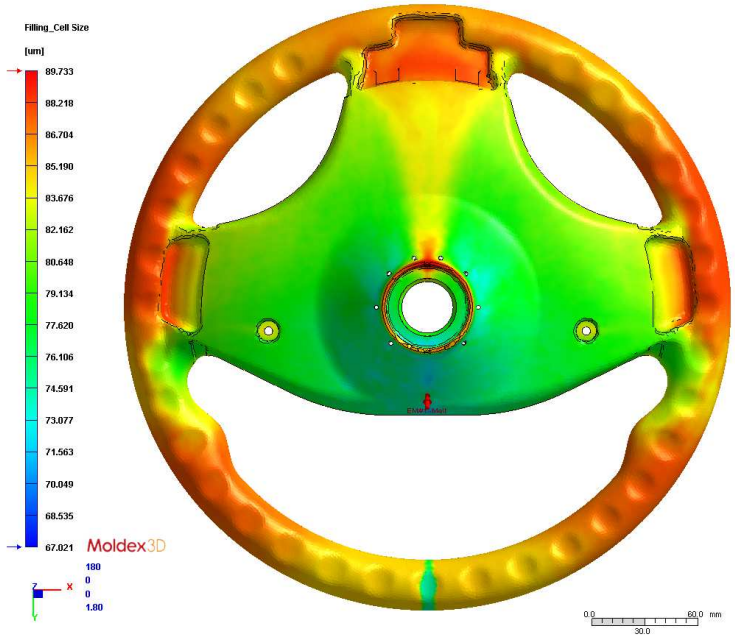


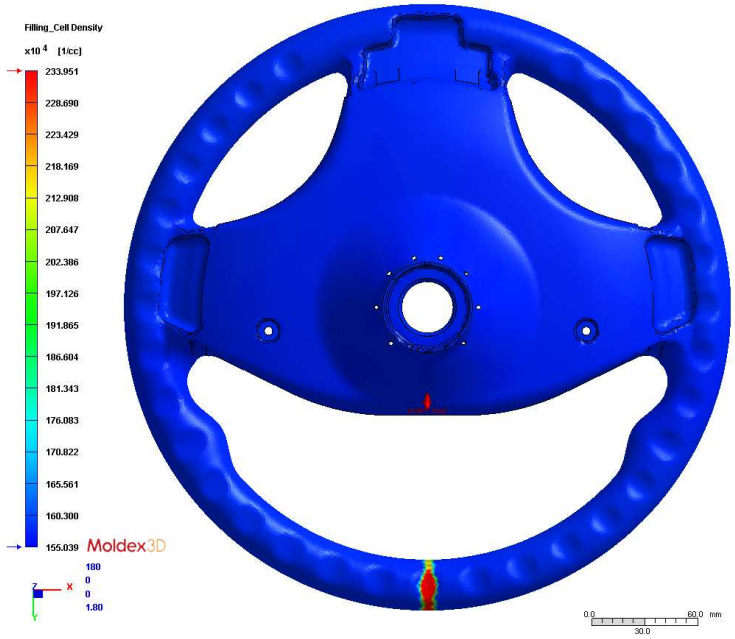




Analysis Output (New in R16)

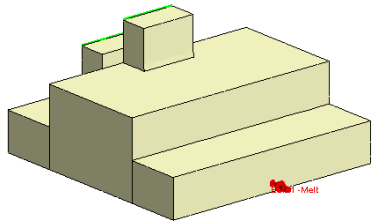
- Cell Size
  - **Foaming cell size distribution**
- Cell Density
  - **Foaming cell density distribution**



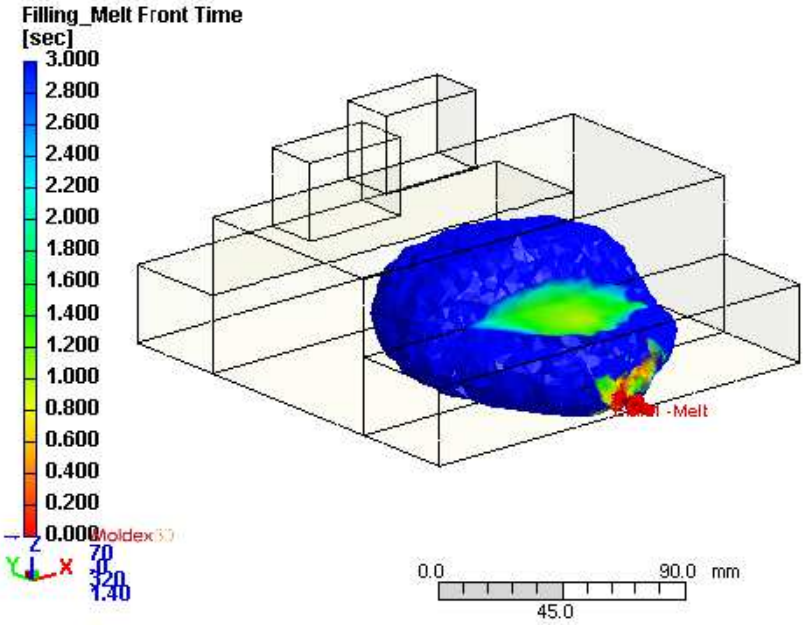


Gravity Force Effect

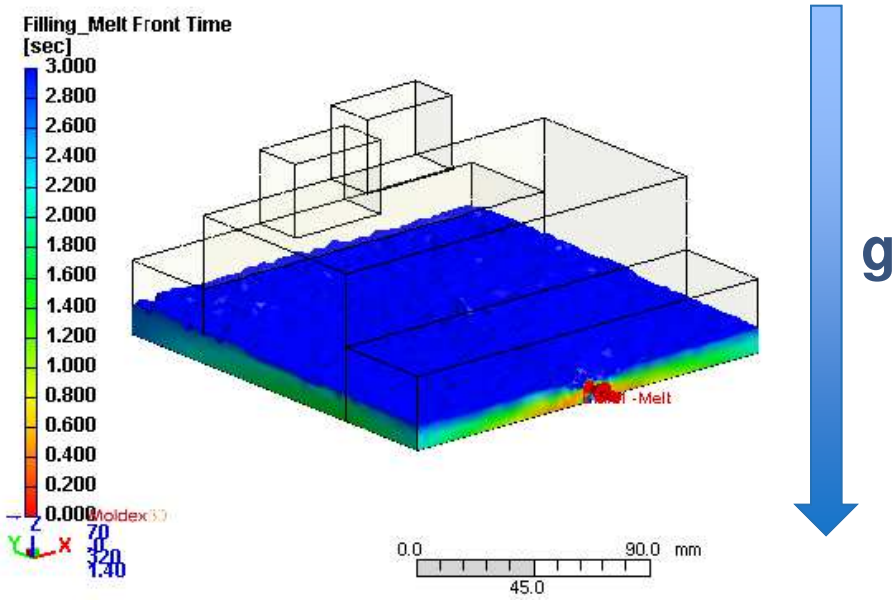
> Under the gravity force, low viscosity PU foam flows along the bottom of the cavity



without gravity force



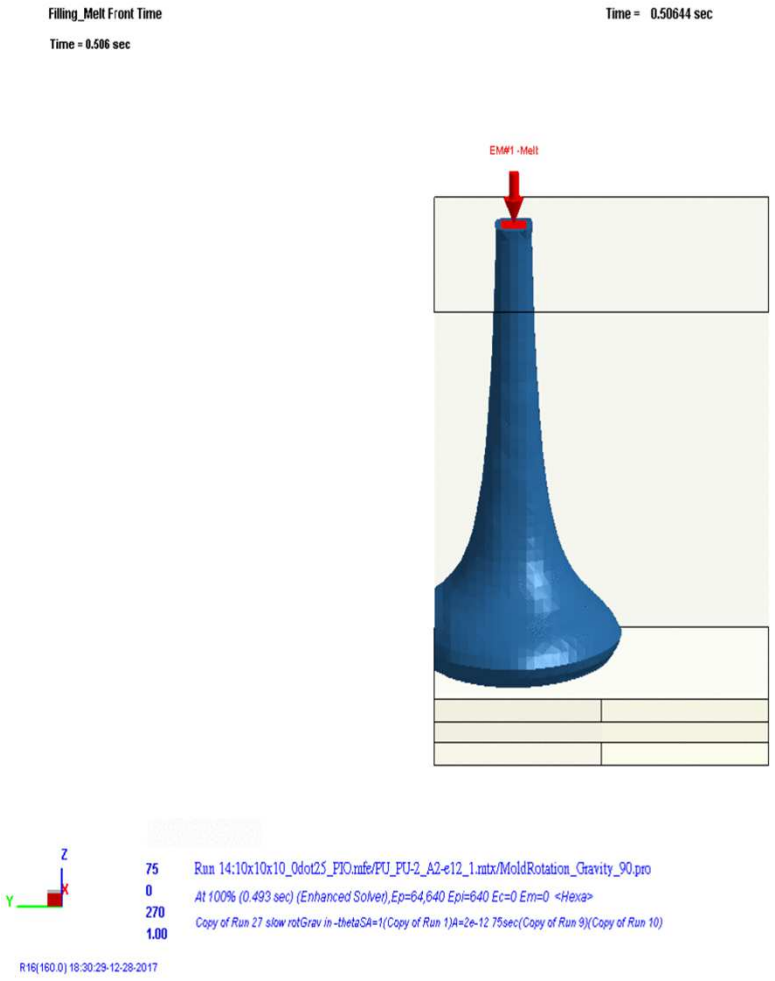
With gravity force



Rotating mold (New in R16)

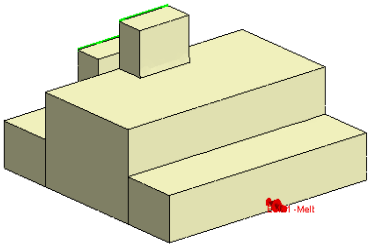
> Supporting rotating mold

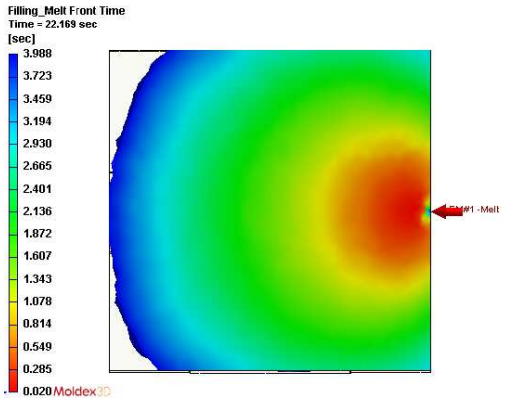
- **Available to simulate the polymer behavior in the rotating mold**



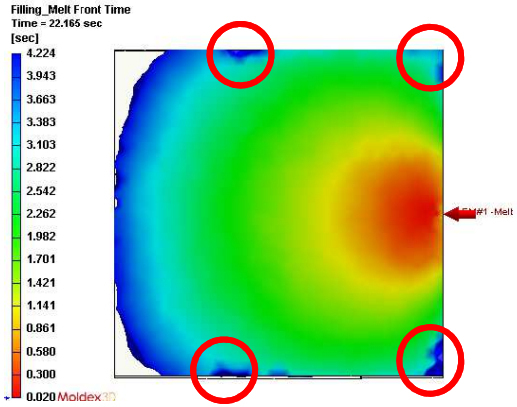
Venting Gap Effect

> No vent gap region provides a high resistance force to compressed air

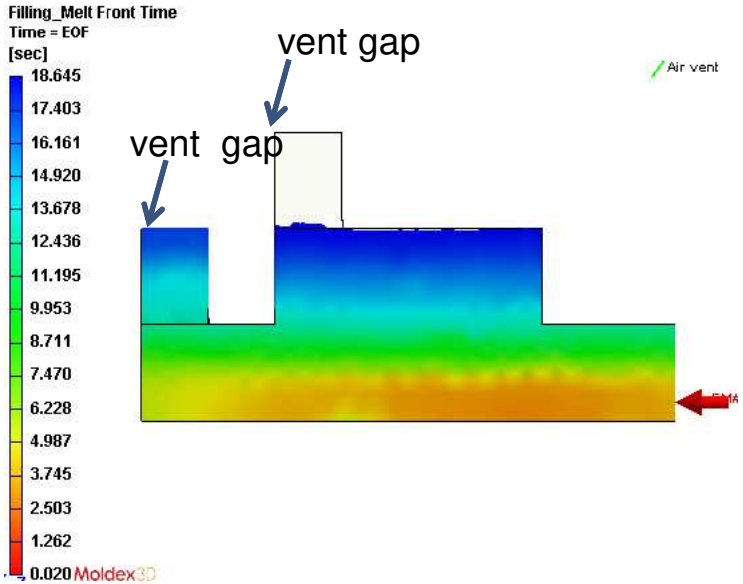


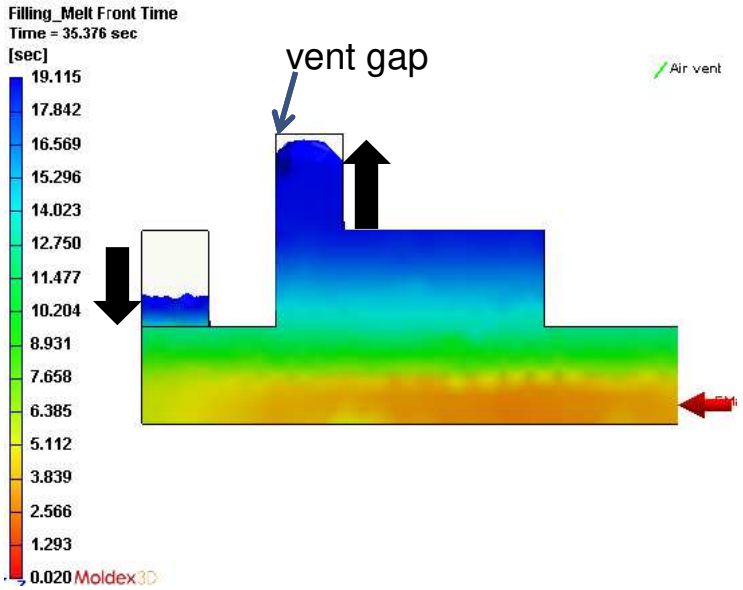


without venting effect



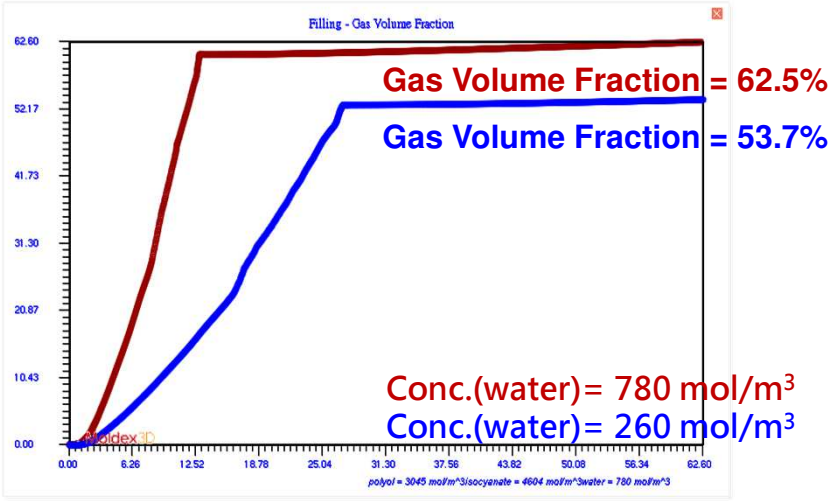
with venting effect



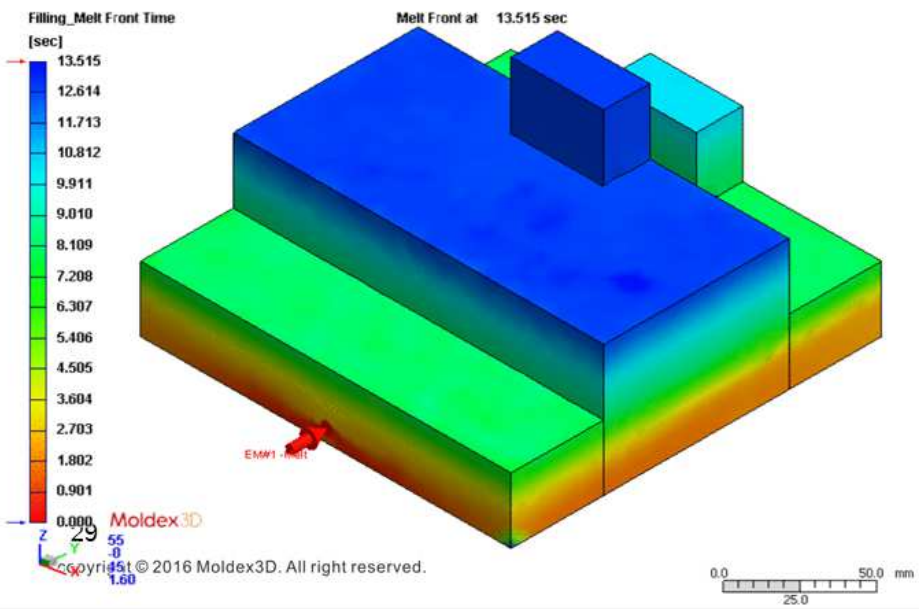


Water (Blowing Agent) Concentration Effect

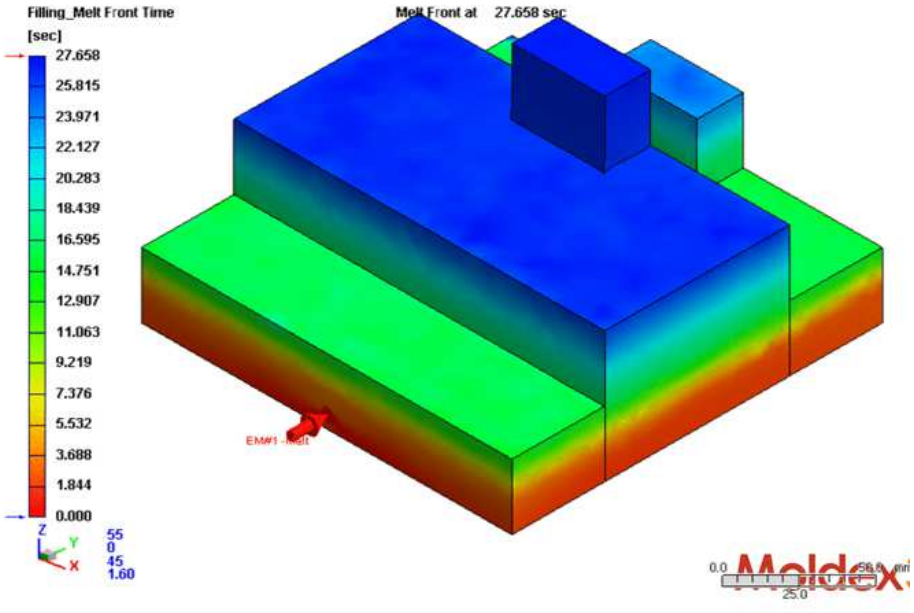
> Higher water concentration causes faster foaming, so shorter filling time



Conc.(water)= 780 mol/m³



Conc.(water)= 260 mol/m³



Moldex3D PU Foaming

> Filling Pattern with foaming behavior

> Foaming conversion rate and density of the part

> Gravity and venting effect

> Warpage prediction

Thank You

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