Rubber Day 2025

L'INDUSTRIA DELLA GOMMA

SIGMASOFT® Rubber Designer:

New Generation and easy-to-use Material Database in Simulation of Rubber Processing

Burkhard Werner
SIGMA Engineering GmbH
www.sigmasoft.de
Milano, 25.01.2025

SIGMASOFT® Virtual Molding

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SIGMA Engineering GmbH

- Foundation in 1998 in Aachen (Germany)

- Associate company of MAGMA Gießereitechnologie GmbH
- Owner-managed company
- Owner of SIGMASOFT® Virtual Molding

- Our core business:
  - Development of SIGMASOFT® Virtual Molding (Aachen) incl. a dedicated rubber team
  - Sales of SIGMASOFT® Virtual Molding
  - Education of SIGMASOFT® users (SIGMAacademy for company specific and individual trainings)
  - SIGMASOFT® user support (application support and project support)
  - Simulation services only on request

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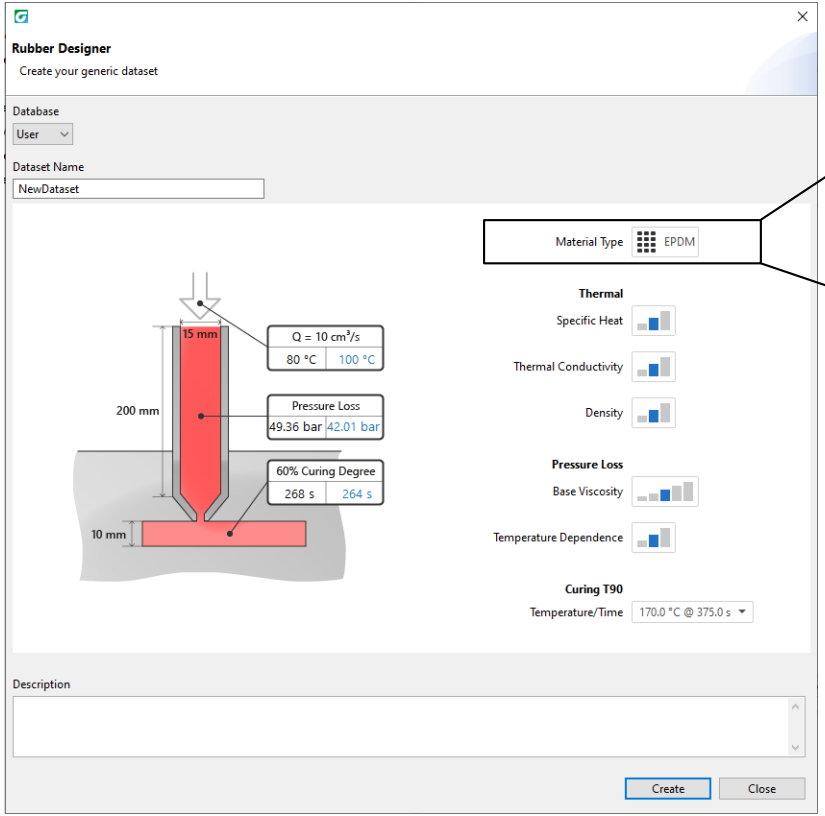
Rubber Designer



ACM	Acrylic rubber	EPDM	Ethylene-propylene-diene rubber
FKM	Fluorocarbon-based fluoro elastomer	HNBR	Hydrogenated acrylo-nitrile-butadiene rubber
NBR	Nitrile-butadiene rubber	NR	Natural rubber
SBR	Styrene-butadiene rubber		

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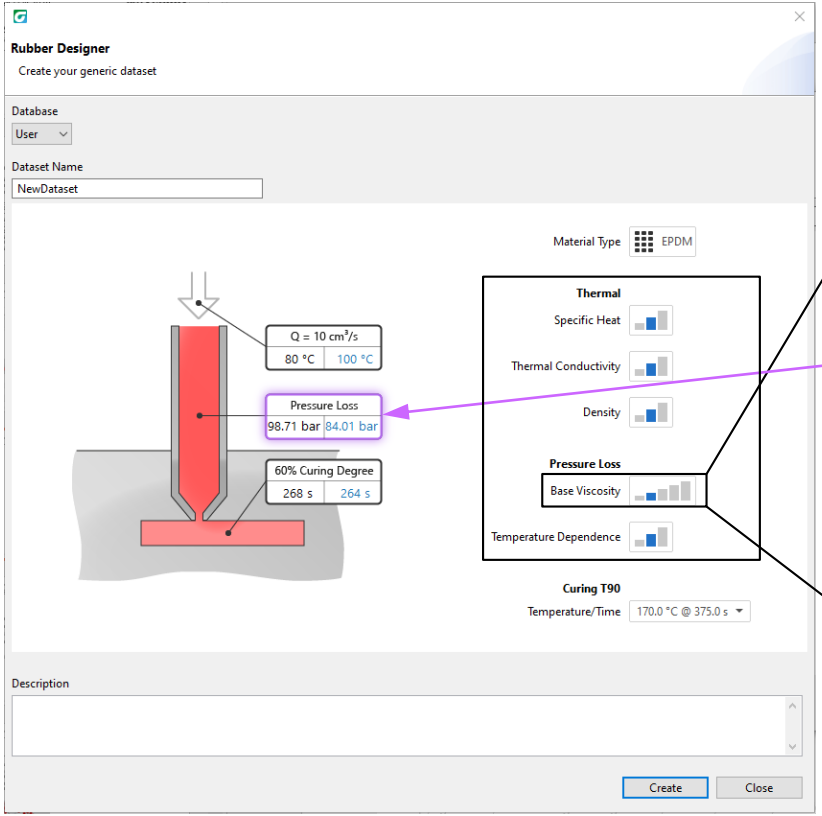
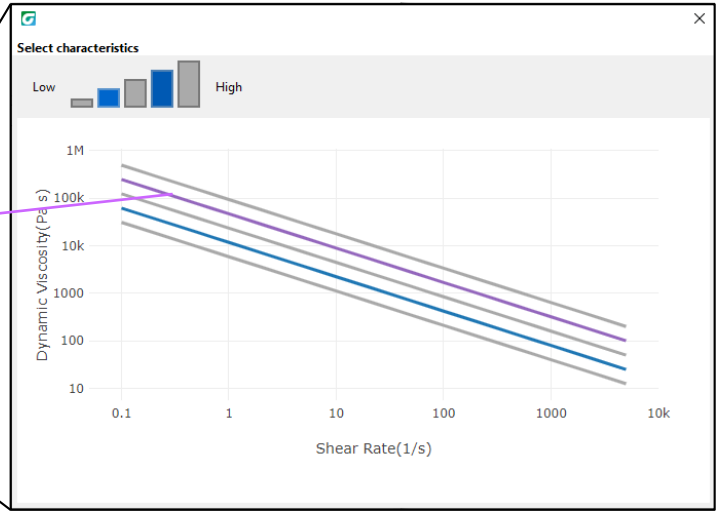
Rubber Designer





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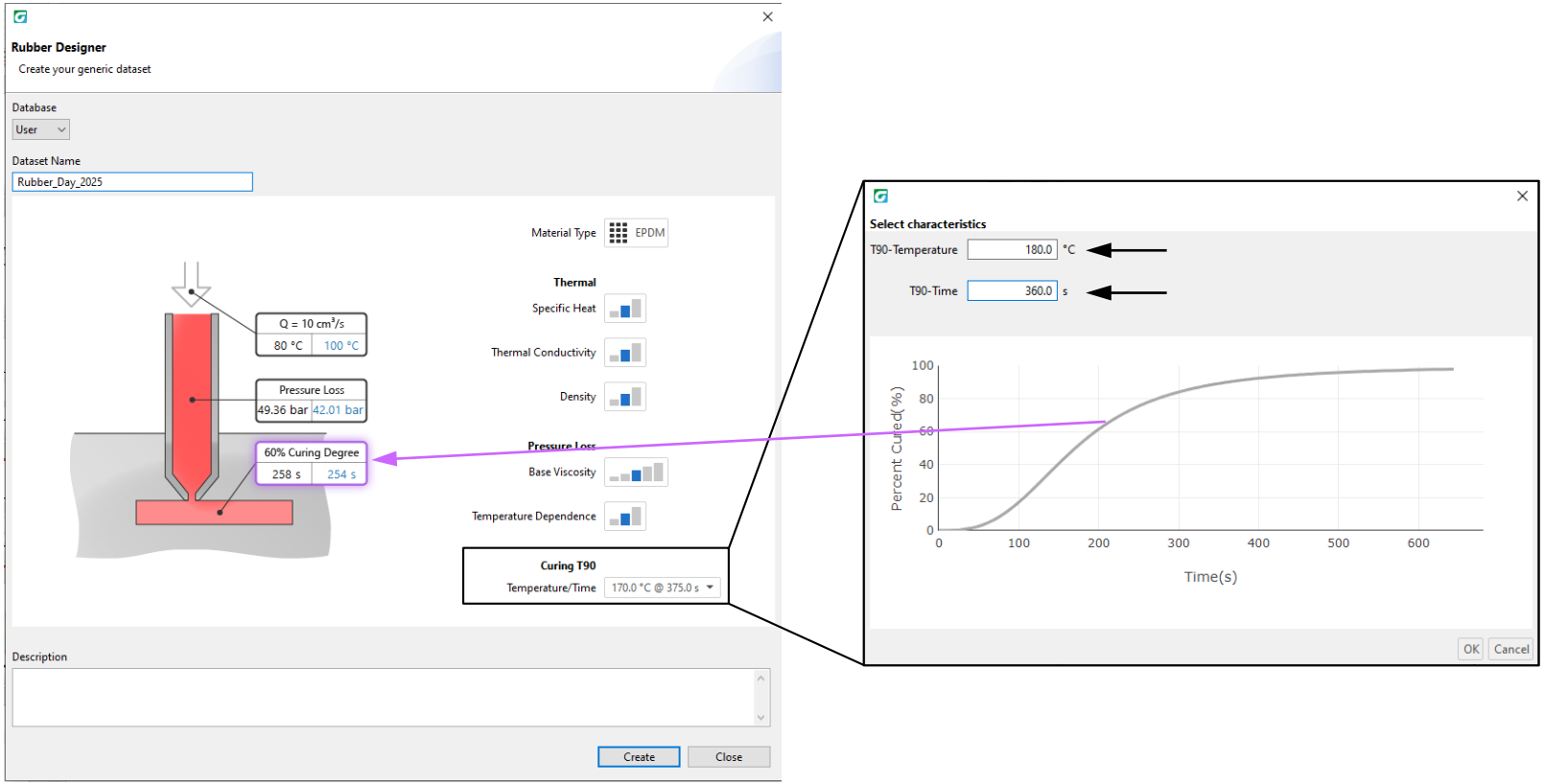
Rubber Designer



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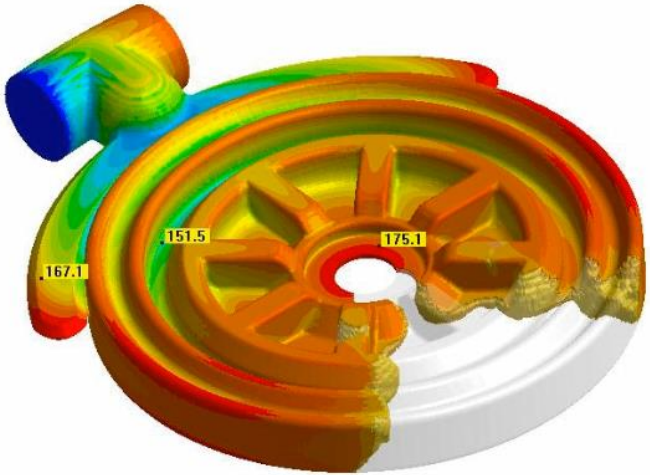
Sealing Disk: Filling of single Cavity

- Assessment of gate position
- Assessment of gate design
- Filling behavior
- Temperature distribution
- Pressure at every point in time
- Air entrapments
- Risk of pre-vulcanized material



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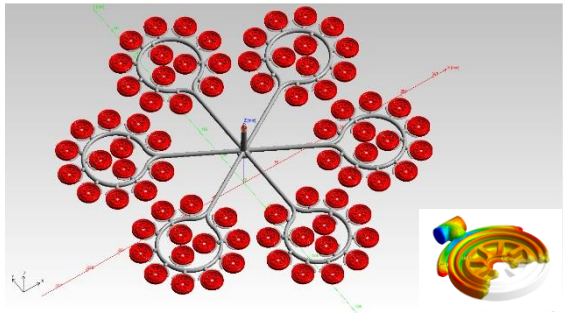
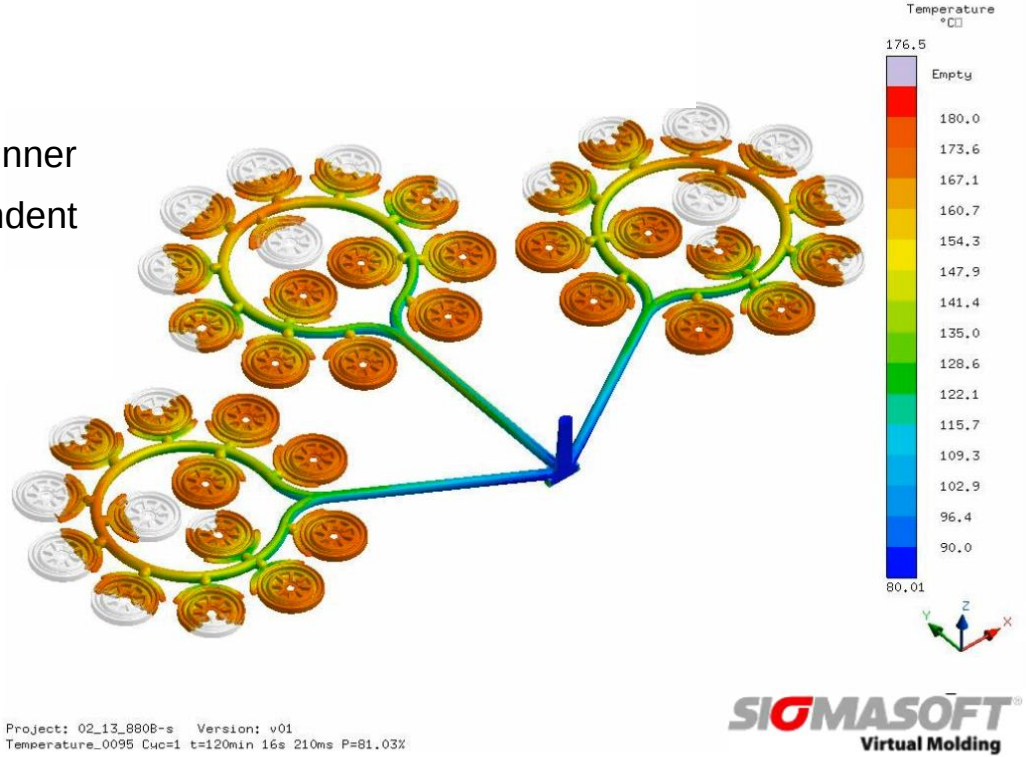
Sealing Disk: Corresponding Runner for 78 Cavities

- High number of cavities possible.
- Assessment of the gate design.
- Filling behavior of all cavities incl. runner
- Temperature distribution time-dependent until end of filling.
- Pressure need to fill the runner
- Pressure need to fill all cavities





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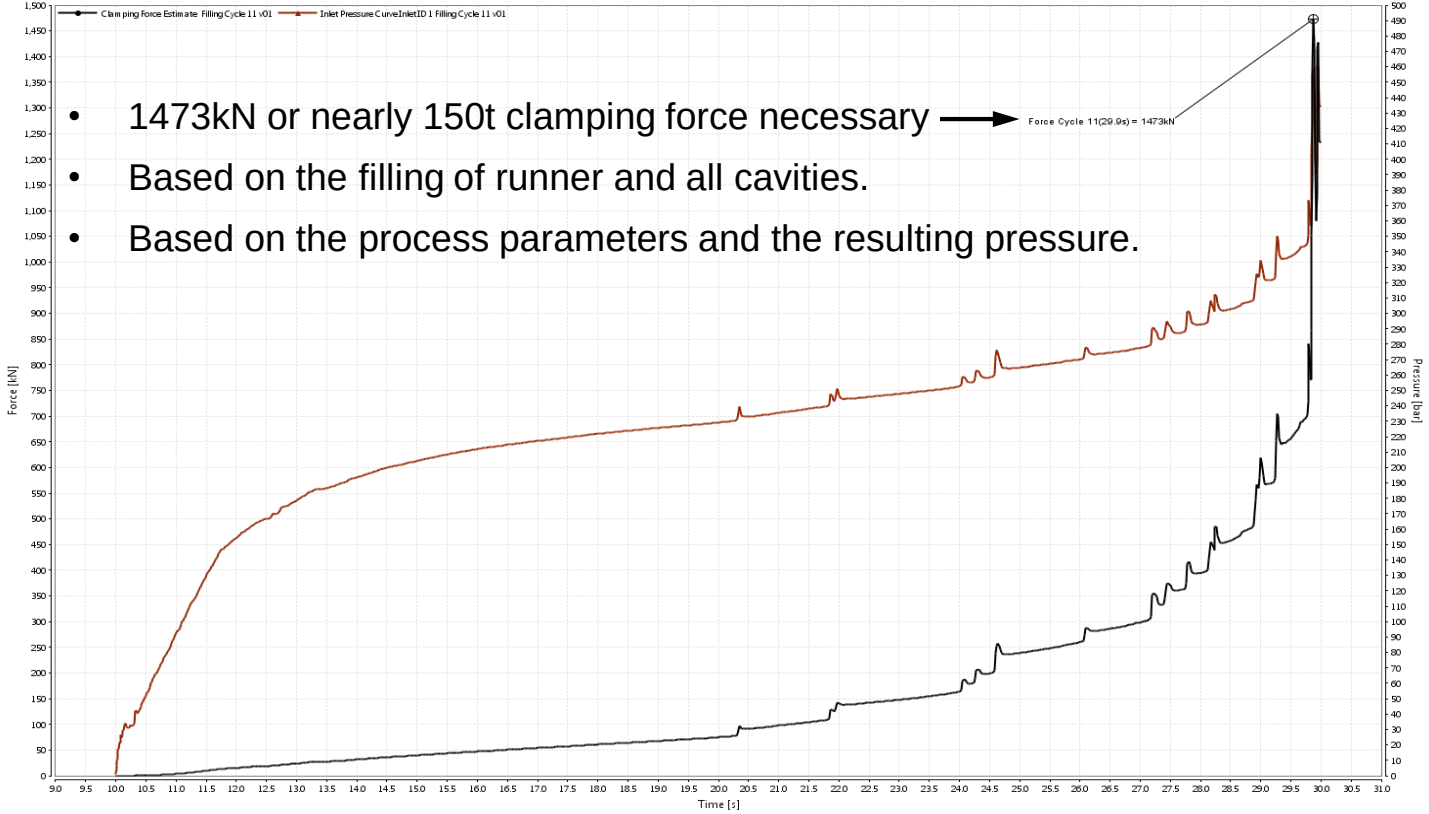
Related Clamping Force



- 1473kN or nearly 150t clamping force necessary
- Based on the filling of runner and all cavities.
- Based on the process parameters and the resulting pressure.

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Material History

Different colors of the injection points show:

- Which rubber from
- Which injection point is
- Where in the cavity at
- What time.

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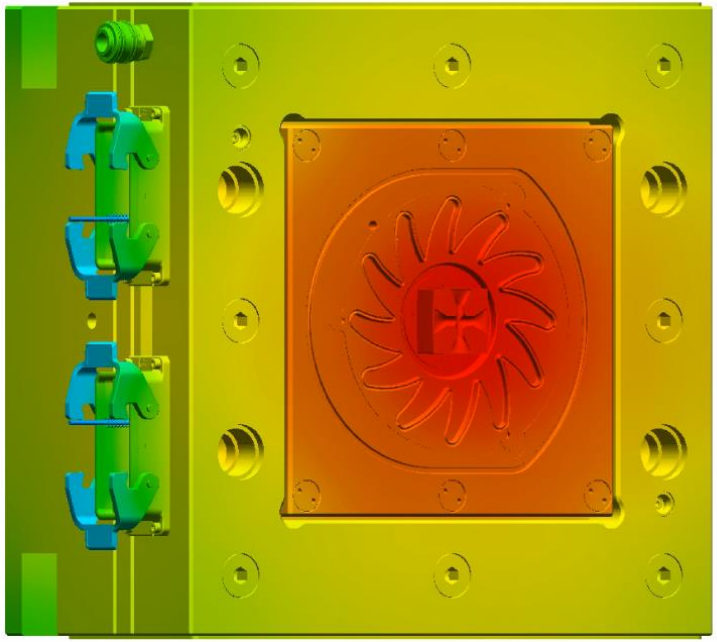
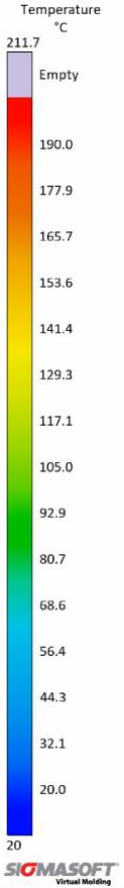
Heating-up and Multicycle-Simulation of the Mold





Starting at room temperature:

- ✓ Layout and technical specifications of heating cartridges
- ✓ Automatic calculation of PI numbers
- ✓ Heating power
- ✓ Temperature distribution
- ✓ Laziness of the mold
- ✓ Thermal separation of cold and hot mold areas
- ✓ Thermal steady state of the mold
- ✓ …

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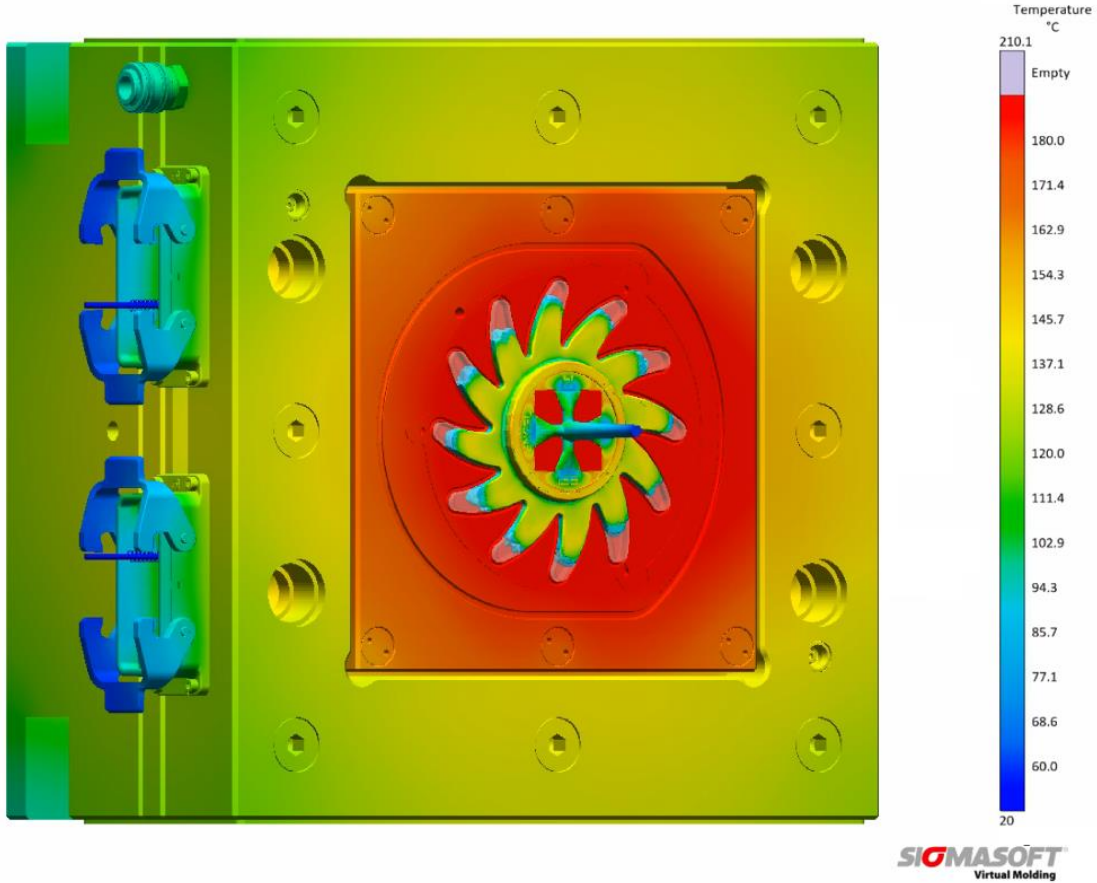
Filling Simulation based on real Mold Temperatures



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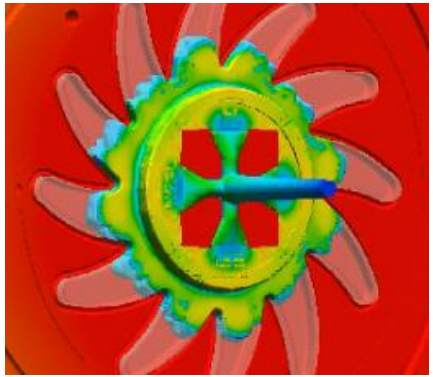
Comparison Simulation – Reality



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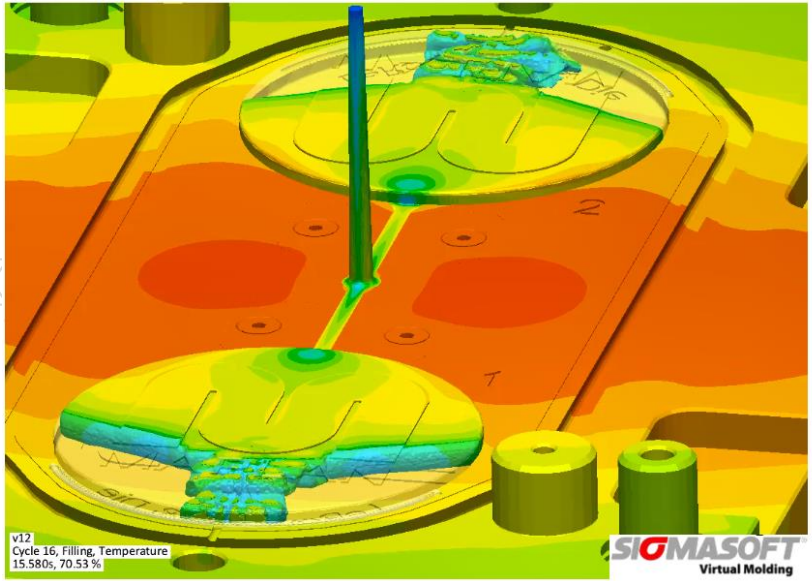
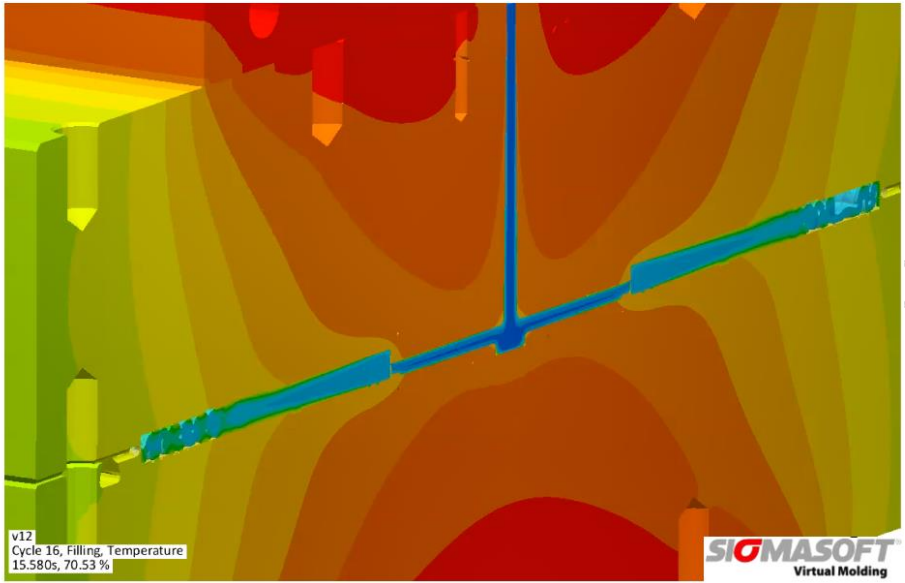
Jetting Effects





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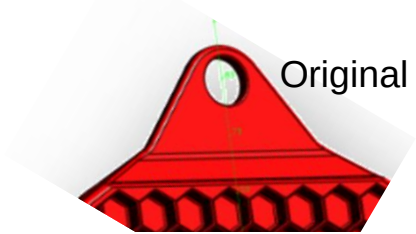
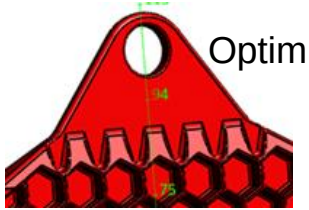
Vulcanization: Assessment of two different Designs

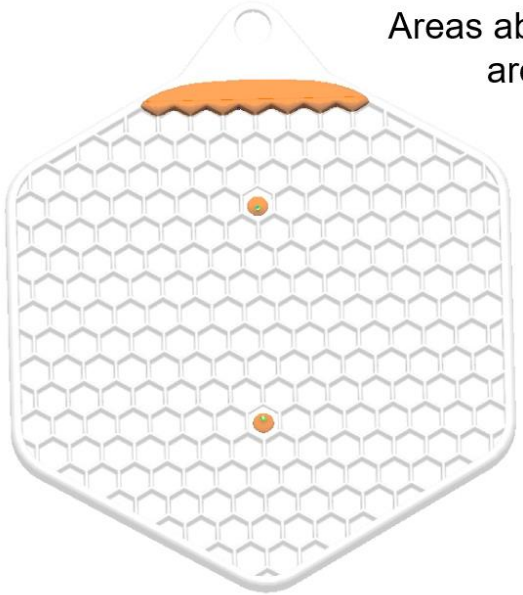


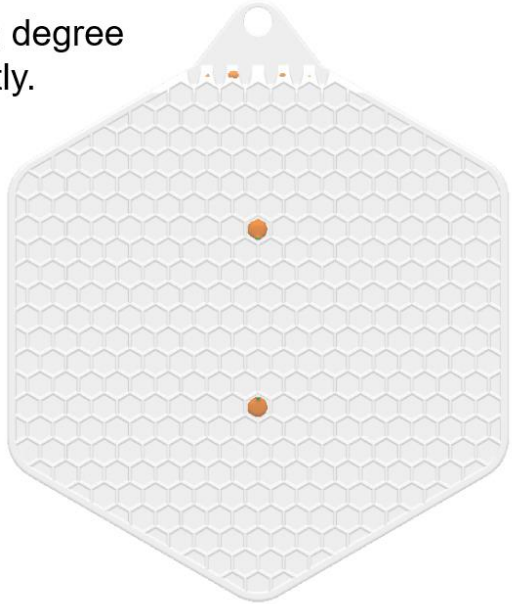
Original design

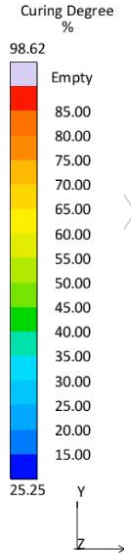


Optimized design

Areas above 80% vulcanization degree
are displayed transparently.







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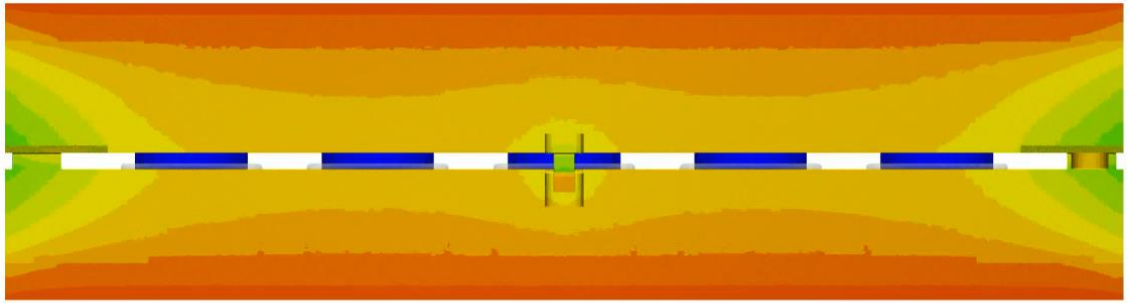
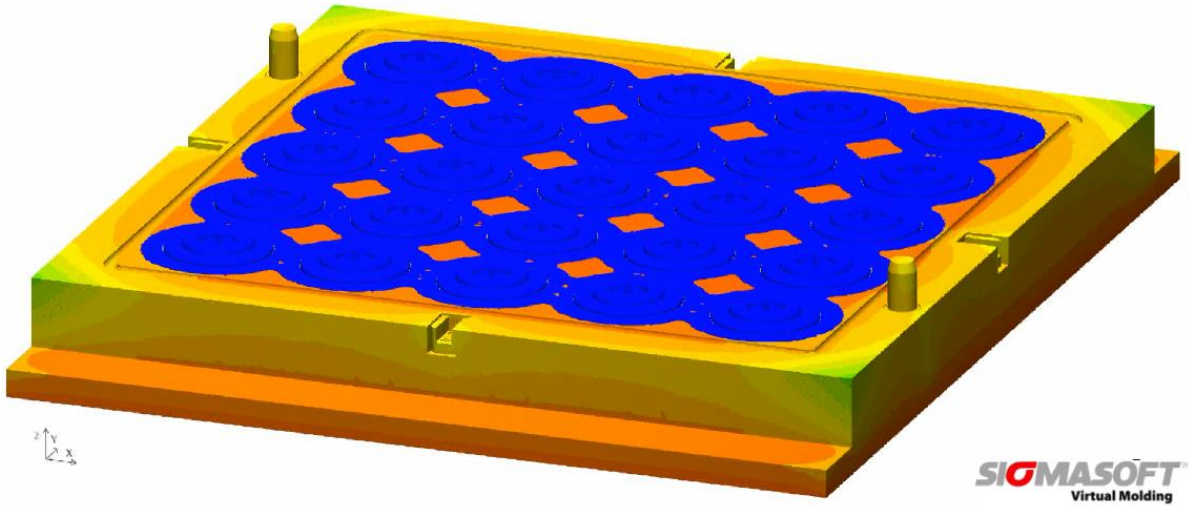
Compression Molding





- Temperatures
- Pressure
- Velocity
- Shear rates
- Scorch (pre-vulcanization during filling)
- Air entrapments
- Non-filled areas
- …

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SIGMA is well established in the Rubber World

Exhibitions (we’re the only ones), e.g.:

- DKT 2000 – 2024 in Nuremberg incl. expert lecture and fair projects
- Silicone Elastomers World Summit 2016 – 2024 incl. expert lecture
- DIK-Meeting „Rubber Injection Molding“ incl. expert lecture and workshops

Technology partnerships incl. fair projects, e.g.:

- MESGO, MAPLAN, REP, LWB Steinl, Engel

Research projects with institutes/universities and different companies, e.g.:

- Improvements of shrinkage calculations
- Link between mechanical properties and vulcanization degree
- Fundamentals and validation of viscoelastic flow behavior

Technical publications regularly in professional magazines, e.g.:

- L'Industria della Gomma

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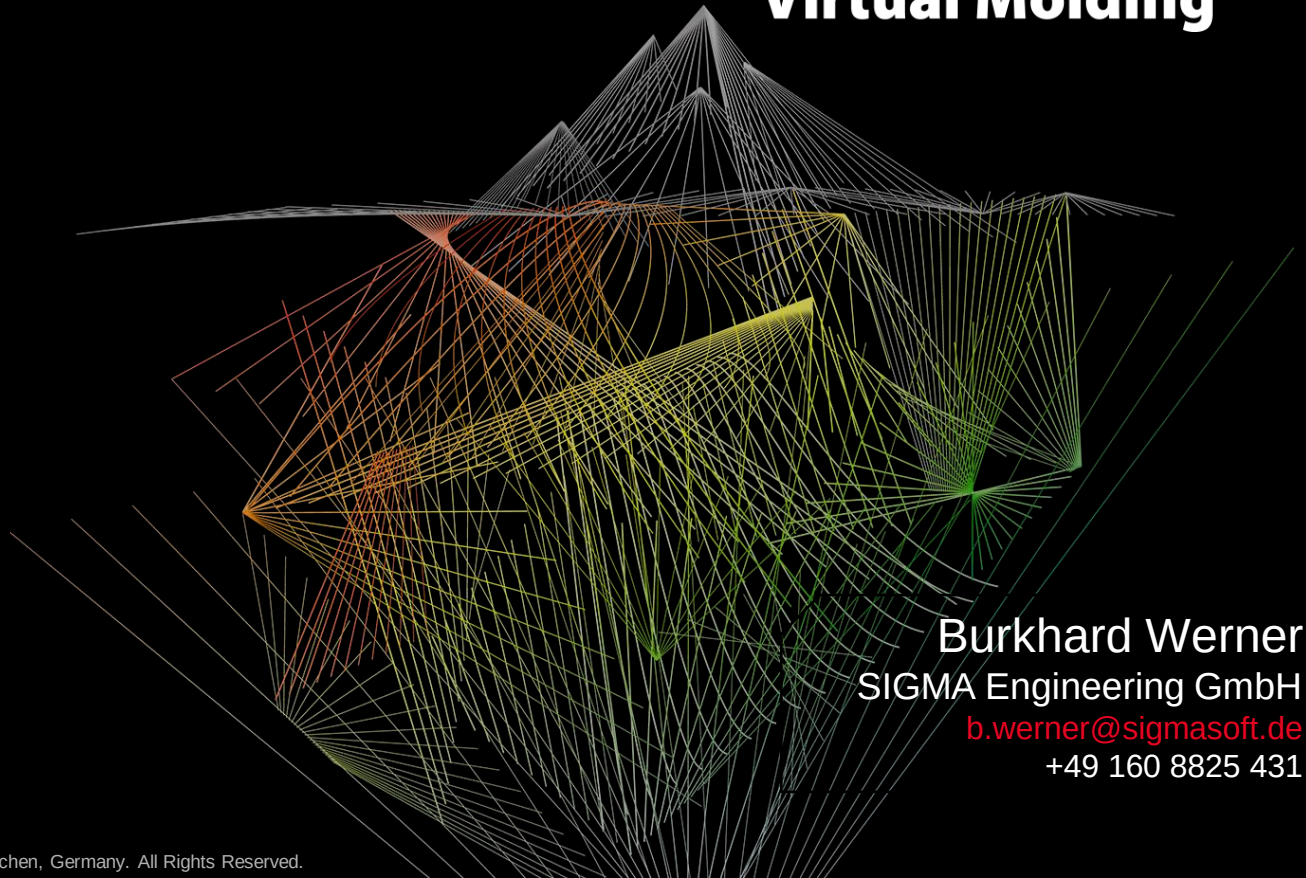

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