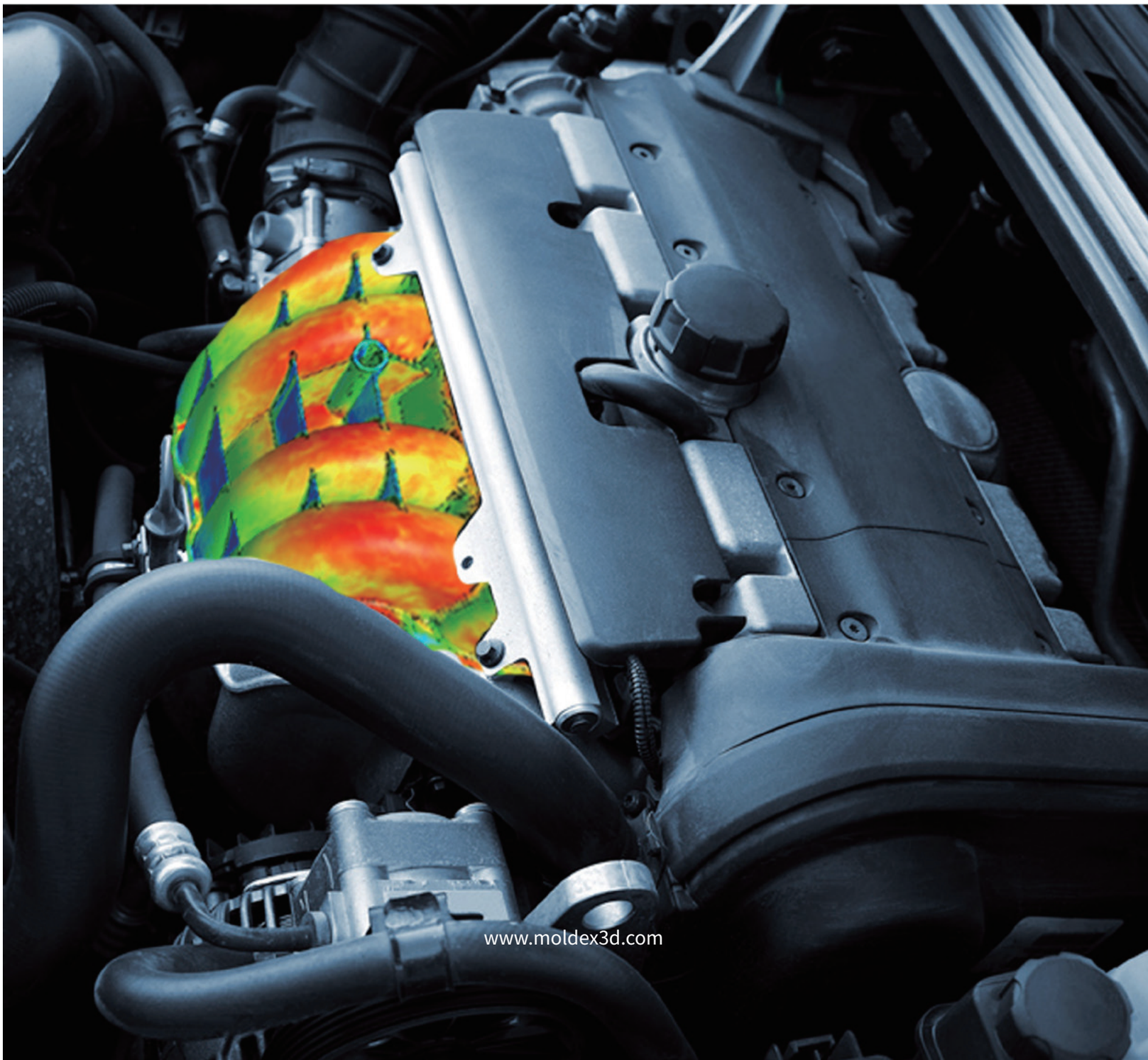
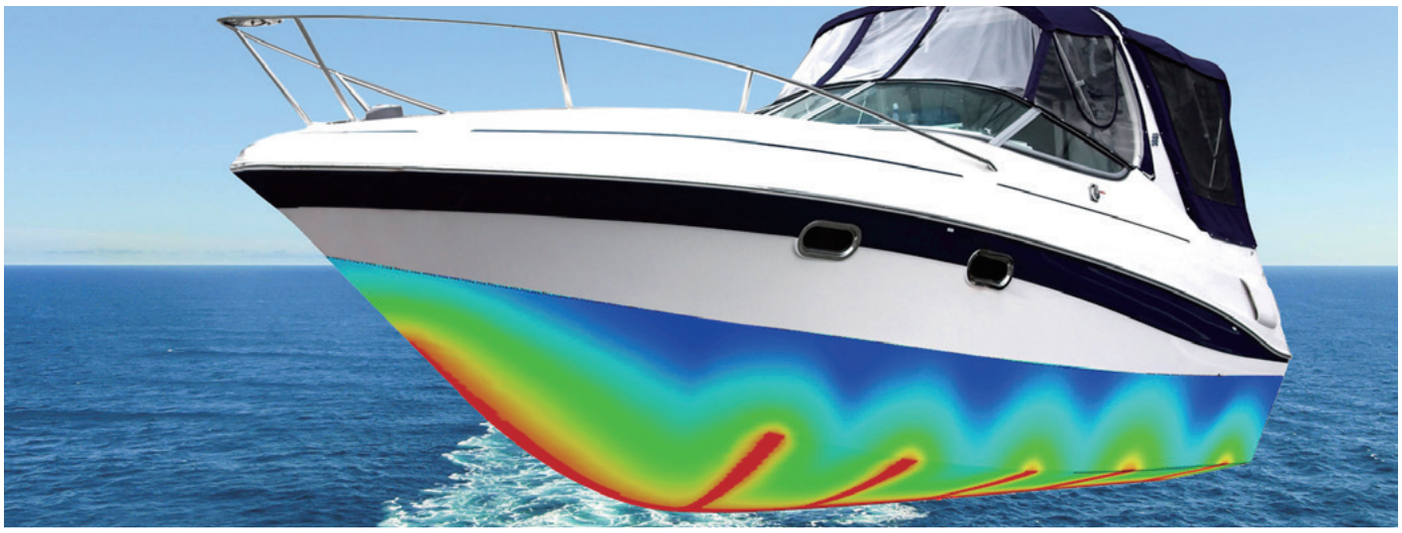
Moldex3D
MOLDING INNOVATION

# Moldex3D Composite Molding

## World-Class CAE Simulation Software

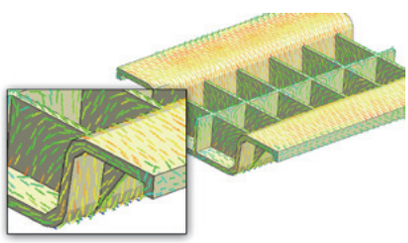




Moldex3D provides various realistic 3D simulation solutions for the composite molding process, such as short fiber injection molding, long fiber injection molding, SMC / BMC / GMT compression molding and resin transfer molding, etc. Therefore, Moldex3D is the best CAE software to help you simulate and visualize the molding process to achieve verification and optimization of product designs, increase manufacturability, shorten time to market, and maximize return on investment (ROI)

## Fiber Orientation Prediction

- Visualize fiber orientation, length, and concentration inside fiber-reinforced plastics.
- Evaluate the filler effect to mechanical properties and final shrinkage
- Optimize process conditions to enhance the part strength.
- Support short, long, flat fiber and flake orientation simulation.

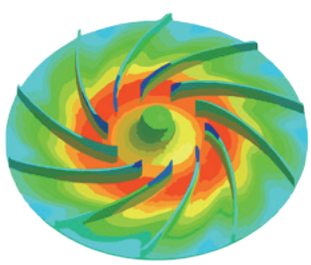


## Resin Transfer Molding

- Predict resin flow behavior through anisotropic porous media.
- Decide appropriate fabric materials, and optimize process conditions.
- Control resin infusion by pressure of flow rate.
- Capture cure reaction trend during molding through viscosity and kinetics models.

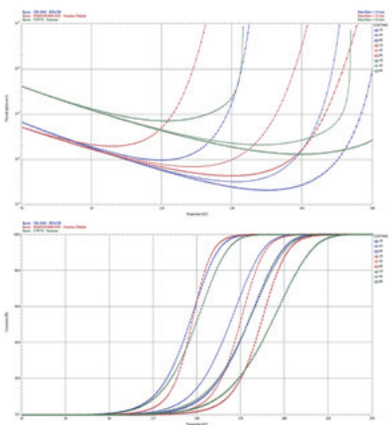
## SMC/BMC/GMT Compression Molding

- Visualize dynamic melt flow advancement during compression molding process.
- Evaluate chopped fiber orientation prediction, compression force response and anisotropic warpage result for SMC/BMC/GMT compression molding.
- Predict Potential molding defects, such as flashing.



## Material Characterization

- Evaluate the variation of temperature and curing kinetics for reactive material.
- Evaluate viscoelastic properties, chemical shrinkage and thermal expansion effect for different components.

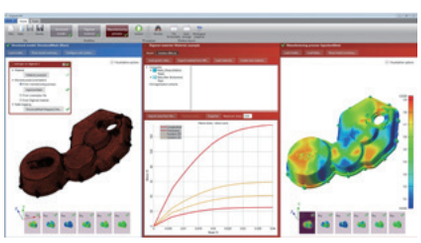


## FEA Interface/Micromechanics Interface

- Integrated with industrial leading structural software, including ABAQUS, ANSYS, LS-DYNA, Marc, NASTRAN, and RADIOSS.
- Export Fiber and Stress analysis results to calculate further structural performance.
- Validate the structural performance of products and mold sustainability.


## Moldex3D Digimat-RP

- Bridge manufacturing process and FEA analysis.
- Predict the mechanical behaviors with nonlinear material modeling technology for reinforced plastic.
- Define material properties and criteria of failure properties for reinforced plastic.
- Support automatic reverse engineering for material model generation based on experiment data.



# PEGATRON Improved the Warpage of a Tablet Base Case Cover

## Challenges

- Short shots
- Air traps
- Shrinkage caused by different wall thickness

## Benefits

- Met target part thickness of 1mm, reducing thickness by 23%
- Significantly reduced warpage by 92%
- Reduced pressure loss by 8.3%
- Reduced scrap by 13%
- Saved more than 6% of manufacturing costs with insert molding

## Solutions

Utilizing the Moldex3D Advanced package to find the main factors of warpage and solved this issue by replacing the materials.

## Case Study

The objective of this case is to improve the warpage. The warpage simulation result indicated the shrinkage effect impact was greater than the thermal effect (Fig. 1).
To fix this problem, PEGATRON tried to add different percentages of glass fiber content materials into the product and use Moldex3D to validate the warpage results. They found the filler could effectively reduce the warpage to meet the specification. The reason was that fiber would orientate along the filling direction (X-axis) to resist the shrinkage.
PEGATRON verified the analysis result with the experiment and found the flow patterns of simulation and experiment have the same trends. As for the flatness verification, the experiment results with different materials were all consistent with the simulation results (Fig. 2)

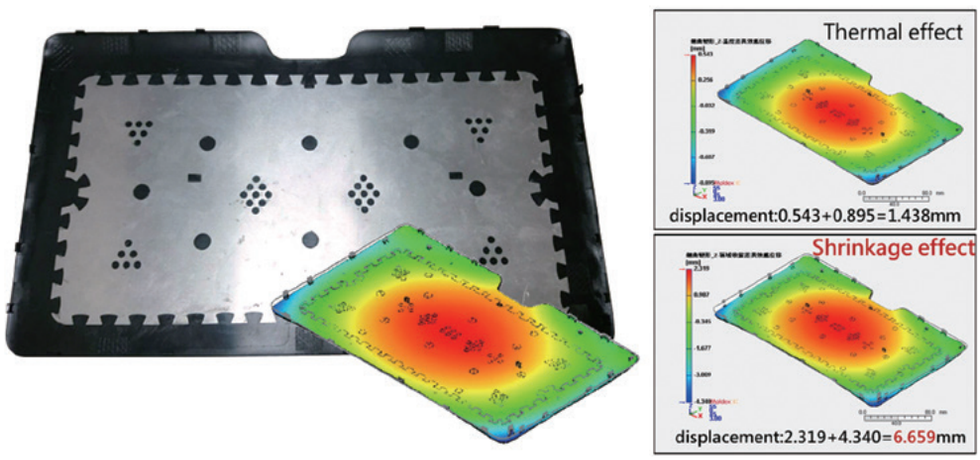



Fig1. The warpage results of the original material

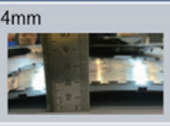
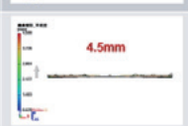
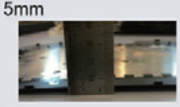
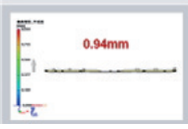
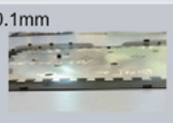
| Flatness Verification | | |
|---|---|---|
| Material | Analysis result | Experiment |
| Sabic Lexan_HFD1830 (PC) |   | 14mm  |
| Sabic Thermocomp_D151 (PC+10%GF) |   | 5mm  |
| Sabic Thermocomp_D452 (PC+40%GF) |   | 0.1mm  |

Fig2. The flatness verification with the experiment results

# CAE Validation of the EASYPERM Measuring Process

## Challenges

- Difficult to capture the filling behavior of anisotropic material
- Find the local pressure during RTM process

## Benefits

- Visualize the flow front evolution
- Successfully predicted the arriving time and the local pressure increasing trend

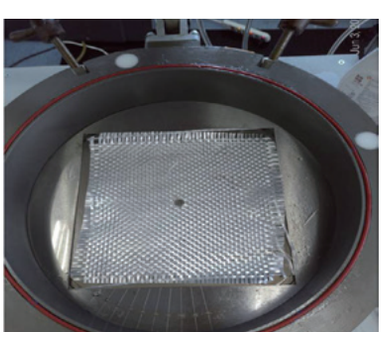
## Solutions

Utilizing the Moldex3D filling analysis to predict flow front evolution and use the sensor nodes get the local pressure trend.

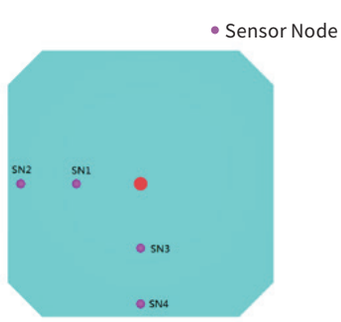
## Case Study

The objective of this study is to get a comprehensive understanding of the permeability measuring process. The instrument EASYPERM is a device used to measure the fabric permeability properties which won the JEC Invention Award in 2015. The instrument measures pressure at different loca-tions through a pressure sensor. This verification case focuses on two properties of the RTM process, the flow front arriving time and local pressure increasing trend in filling process. The geometry and pressure sensor location are shown in Fig1. Fig2. shows the comparison of the flow front arriving time and local pressure increasing trend between the experimental and the simulation results. The dot lines are the experimental results and the solid line is simulation results. The local pressure increasing trend of simulation is in good agreement with the experiment. By using the simulation tools, we can observe the fluid flow within the mold. The comparison between simulation and experiment result shows the reliability of simulation result.

(a) Outward appearance of the mold



(b) Fabric preparation

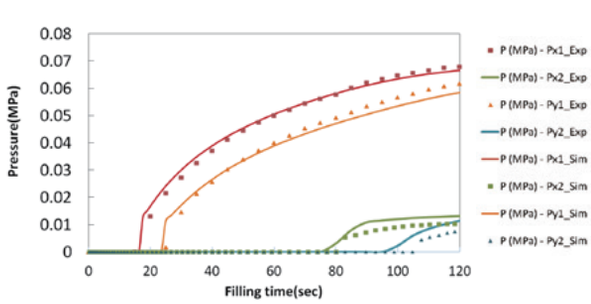



(c) Cavity geometry and pressure sensor location

Fig1.

| | EASYPERM(sec) | Simulation(sec) |
|---|---|---|
| SN1 – X1 | 16 | 17.8 |
| SN2 – X2 | 78 | 77.5 |
| SN3 – Y1 | 24 | 23.9 |
| SN4 – Y2 | 99 | 107.7 |

Fig2.(a) Flow front arriving time




(b) Local pressure vs filling time

## ISO 17025 CERTIFIED

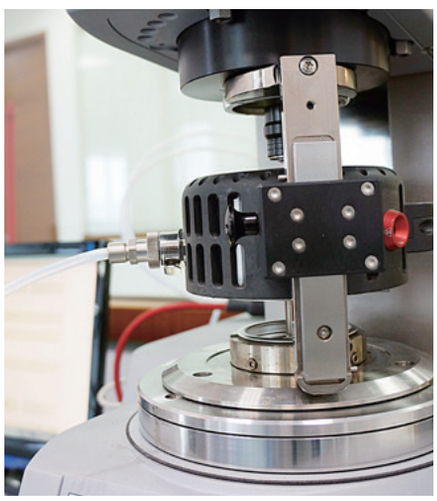
Moldex3D Material Research Center has the best in class equipment to help customers obtain the most reliable and precise material data.

### What We Provide?

- Thermoplastic / Thermoset Material / Fabric Testing
- Custom and Flexible Testing Item
- Alternative Material Suggestion
- Data Fitting
- Custom Report

### List of Instruments

- DHR-3 (TA)
- MCR-502 (Anton Paar)
- Rheograph RG-25(Gottfert)
- MDR-A1 (U-CAN)
- DSC-8500 (Perkin Elmar)
- PVTC-A1 (U-CAN)
- FOAMAT 285 (Format)
- EASYPERM
- DMA-Q850 (TA)
- Instron 5966 (Instron)
- TMA-4000 (Perkin Elmar)
- PVT-6000 (GoTech)



# PRODUCT PORTFOLIO AND FEATURES

● Essential features contained | ○ Optional features

## Standard Package

| Molding Process | | Composite Molding |
|---|---|---|
| **Mesh Technology** | Mesh | ● |
| **Simulation Capabilities** | Flow, Cure, Warp | ● |
| | Thermal Analysis | ● |
| | Stress | ● |
| | FEA Interface | ● |
| **Solver Capabilities** | Project | ● |
| | Parallel Processing | 8 |

## Material Test

| | High Shear Rate Viscosity | Low Shear Rate Viscosity (With Fiber) | Curing Kinetics | Permeability(EASYPERM) Porosity |
|---|---|---|---|---|
| Resin | | | | |
| Thermoset | ● | ○ | ● | |
| Thermoplastic | ● | ○ | | |
| Fabric | | | | |
| Dry fabric preform | | | | ● |

# SYSTEM REQUIREMENTS

| | |
|---|---|
| **Platform** | |
| Windows | Windows 10, 8, 7, Server 2016, Server 2012 R2 |
| **Hardware** | |
| Minimum | Intel® Core i7 processor, 16 GB RAM, and at least 1 TB free space |
| Recommended | Intel Xeon Platinum 8000 series processor, at least 64 GB RAM & 4 TB free space HDD, NVIDIA Quadro & AMD Radeon series graphic card and 1920 x 1080 screen resolution |

## Automotive


## Electronics


## Material / Consumer / Others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