TECHNICAL SERVICES

Avient Specialty Engineered Materials

AVIENT™

COULD YOUR PRODUCT DEVELOPMENT PROCESS BENEFIT FROM ADDITIONAL RESOURCES THAT EXPAND YOUR DESIGN, DEVELOPMENT, TESTING, AND TECHNICAL CAPABILITIES?

When you work with Avient, you get more than an unmatched materials portfolio. You gain access to world-class experts who use cross-industry knowledge, a deep understanding of application requirements, specialty materials expertise, and comprehensive technical services to assist customers around the world in overcoming these challenges.

We use our unique, consultative approach to solve difficult design, engineering, and manufacturing challenges allowing customers, like you, to:

- Simplify your product development process
- Expand bandwidth and supplement internal resources
- Accelerate speed to market
- Differentiate products
- Streamline and optimize production

With global facilities and localized support to help you where you are, our experts serve as an extension of your product development team to take you from concept to marketplace with speed and rigor, using a full suite of end-to-end support services.

SUPPORT SERVICES

- Application Understanding
- Material Selection
- Application Development
- Computer-Aided Engineering
- Onsite Technical Support

APPLICATION UNDERSTANDING

We have designers and engineers who are well-equipped to support customers from conceptualization through production. We work collaboratively to fully understand the performance requirements, industry nuances, and regulatory demands needed to bring a vision to life. We then provide vital insight into the material selection, design, molding, and manufacturability to solve the biggest challenges.

Ideation Topics

- Customer vision
- Performance requirements
- Environmental exposure
- Failure modes
- End-of-life (reclaiming) options
- Regulatory compliance demands

MATERIAL SELECTION

Each application is unique and requires careful evaluation of materials to meet the various requirements. Avient offers a broad range of specialized and sustainable engineered polymers, thermoplastic elastomers, colorants, and additives that can be formulated to meet custom product specifications and performance requirements of a given application.

Proper material identification and characterization empower customers with confidence and foster innovation. At Avient, our in-house capabilities allow us to quickly move opportunities through the product development pipeline.

Through both fully accredited testing and in-house testing capabilities, our team uses state-of-the-art equipment and software to generate data for insight into material behavior, environmental effects, and more.

Internal Testing Available

- Physical
- Rheological, thermal, and moisture analysis
- Dielectric properties
- Laser etching and welding
- Microscopy
- Liquid, gas, and size exclusion chromatography
- Atomic, infrared, and nuclear magnetic resonance spectroscopy
- Flammability
- X-ray diffractometry
- Weathering (QUV & Xenon Arc)
- Failure analysis

APPLICATION DEVELOPMENT

Avient has design, application development and degreed plastics engineers available to give our customers reliable and experienced guidance to help navigate the development process.

As inherent problem solvers, we help connect the dots between material, color, design, and manufacturing through a full suite of industrial, material, component, mold and process design capabilities. Avient Design, our in-house team of industrial designers and project engineers, understand materials and manufacturability for a streamlined process to create products that perform better. This perspective, rooted in advanced design and detailed analysis, fosters innovation and expands opportunities for our customers to gain market share.

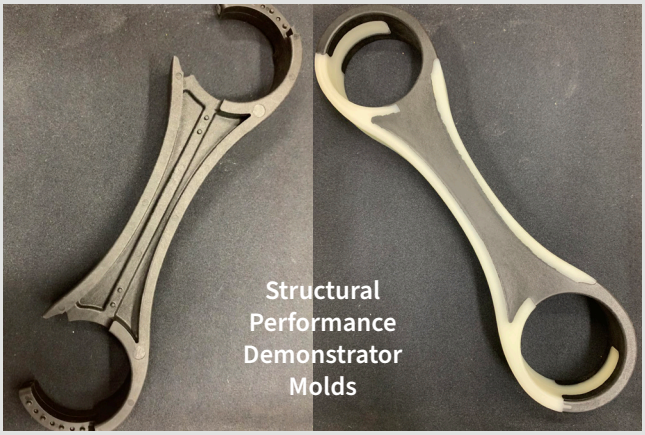
Industrial Design

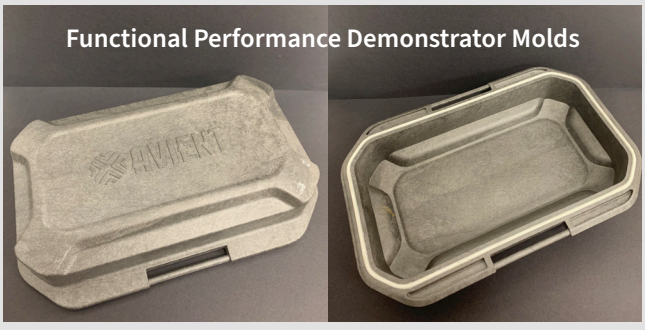
- Research methodologies
- Brainstorming/problem solving
- Concept sketching
- Ergonomic development
- 3D CAD modeling
- Photo rendering & 3D prototyping
- Color, material, & finish selection
- Design for manufacturing

Part/Tool/Process Design Optimization

Prototype Capabilities

- Over 10 injection molding machines ranging from 50–550 tons:
  - Materials sampling and evaluation
- Fully automated continuous fiber reinforced thermoplastic (CFRTP) injection-overmolding cell
  - Prototyping combinations of injection molded discontinuous fiber reinforced thermoplastics with CFRTP inserts
- Full suite of auxiliary support equipment including:
  - Material drying
  - Water and hot oil thermolators for mold heating
  - Ultrasonic welding for inserts
  - Secondary & post operations
- Profile extrusion
- Co-extrusion film and wire & cable
- Over 20 molds at varying geometries to validate structural, application, and functional performance. The images below show just three in-house molding tools designed for demonstrating and testing materials for different shapes and application demands.





Product Validation Molding With Customer Tooling

- Avient also has the ability to bring customer tooling onsite to conduct trials. This enables us to evaluate how different materials perform and to establish best practice processing parameters.

COMPUTER-AIDED ENGINEERING (CAE)

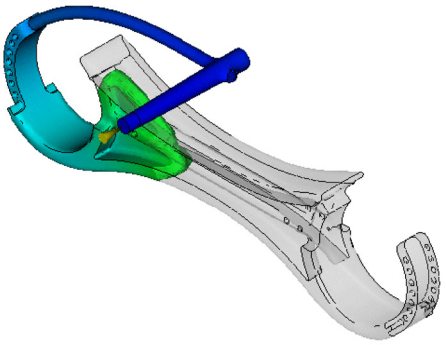
We utilize a combination of CAE tools to virtually simulate real-world application performance. This predictive analysis eliminates costly surprises by evaluating the part design and material selections for both manufacturability and end-product performance before investing in equipment.

Material Data Sets

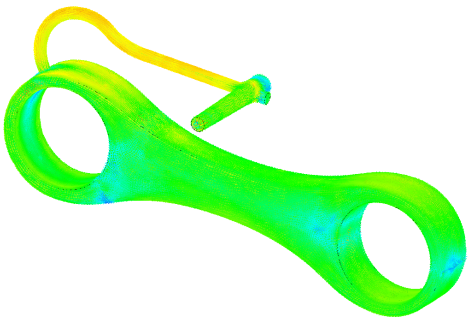
- A number of material characterization data sets are available in .udb, moldex 3D, xChange data cards, and SIPOE format

Mold Filling Simulation (see examples below)

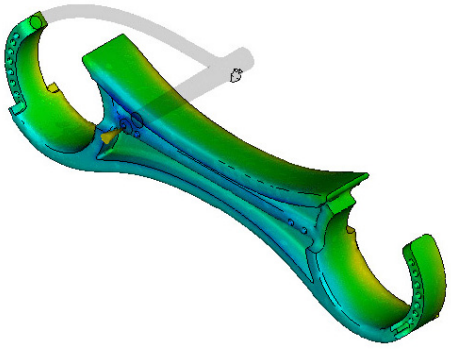
- Serves to validate part design (e.g., gate location, fill/pack/warp/cool) & material solution
- Evaluates component design viability with preferred Avient material solution
- Fiber analysis determines fiber orientation and length
- Predicts part quality and manufacturability (shrink, warp, weld line location)



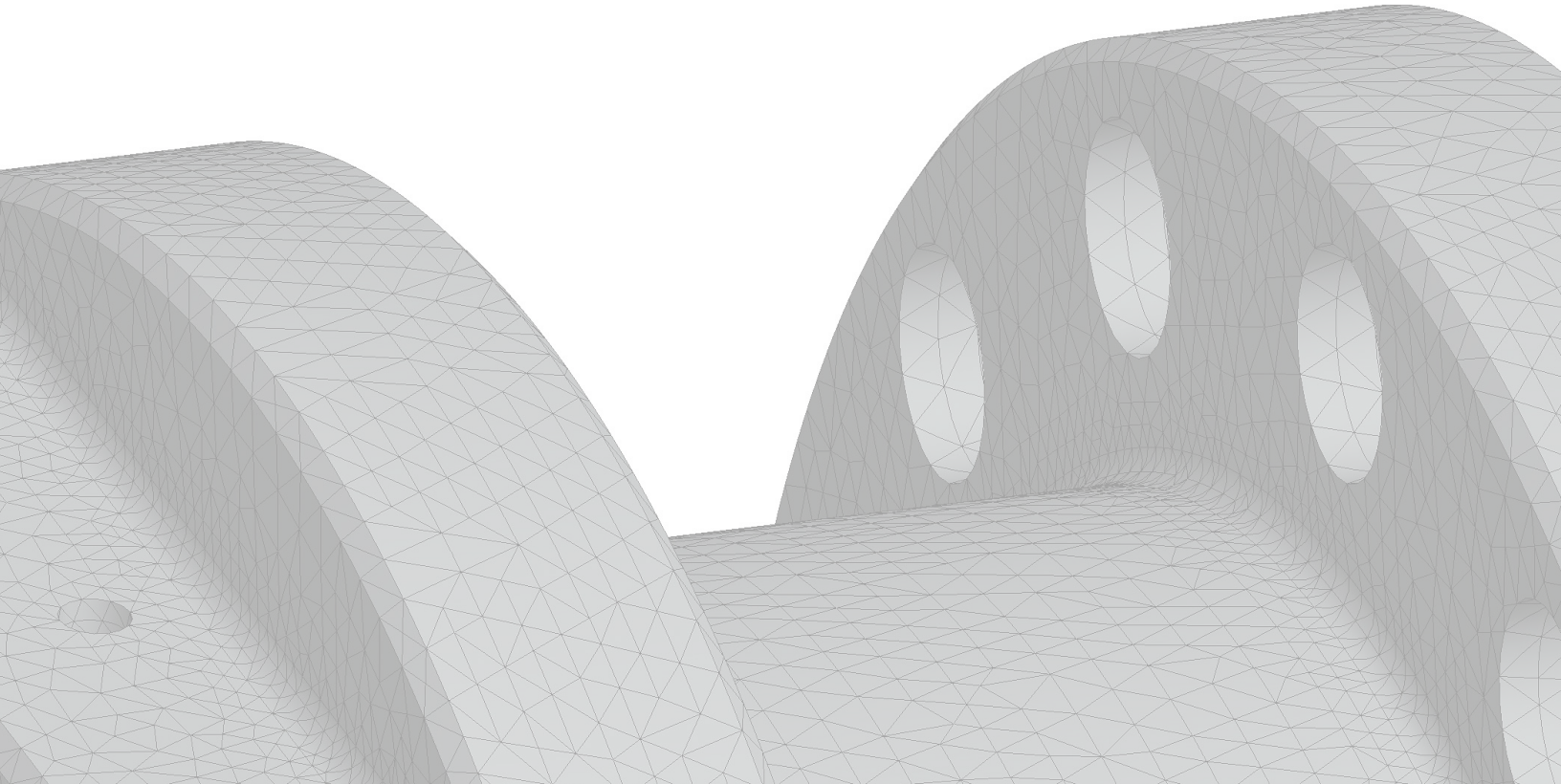
FILLING



FIBER ORIENTATION



PART QUALITY

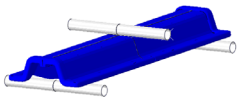


Finite Element Analysis (FEA)

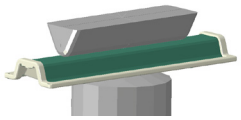
- Virtually simulates how an application will perform in real-world conditions with a high level of precision
- Able to represent a variety of problems, test methods, models and outputs to evaluate the design, process and material combination for validation or optimization

FEA Simulation Capabilities

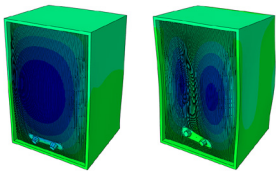
- Static
  - Displacement/rotations
  - Stress and strains
  - Contact pressure
  - Reaction forces/moments
  - Factors of safety



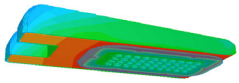
- Dynamic
  - Acceleration
  - Impact
  - Break/no break
  - Transmitted force
  - Energy absorption



- Vibration
  - Eigen frequencies
  - Harmonic response
    - Harmonic displacement, acceleration and stress



- Thermal Mechanical
  - Temperature Computational Fluid Dynamics (CFD)
  - Heat path
  - Dominant heat transfer
  - Temperature mapping
  - Coupling with mechanical simulations



Software Used

- Autodesk Moldflow
- Digimat
- Simulia/Abaqus
- MSC Cradle
- CAD/CAE
  - MSC Apex
  - SolidWorks

Failure Mode Effect Analysis (FMEA) Support

By leveraging mold filling simulation, multiphysics simulation, and the understanding of the link between design, process and material, we can help inform your decision-making process for product development. Our breadth of materials, design and technical expertise allows us to select from a range of solutions to more accurately predict performance and confirm that requirements are being met. In addition to common environmental simulation or functional performance testing services, Avient can also conduct individualized testing and simulations in order to optimize material formulations, product performance, or design.

ONSITE TECHNICAL SUPPORT

The product development process does not end with design and testing. That is why Avient's suite of services also includes local technical support with consultation on process development, mold design/construction, material training, troubleshooting, and continuous improvement.

Identify Equipment Needs

- Material handling and drying equipment needs and sizing
- Primary processing equipment improvements
- Secondary operations equipment improvements

Optimize Processes

- Material preparation
- Primary process development
- Secondary operations process development
- Tooling debug/optimization

Troubleshooting

- Failure analysis/issue resolution
- Process/mold support
- Equipment review

Training

- Polymers fundamentals training
- Polymer types training

Avient's unique combination of materials, design expertise and technical services enables us to conquer challenges and unlock the potential of innovation in meaningful and dynamic ways for customers around the world. Our people, ideas, material science, resources and unwavering commitment to service enable customers to transform their visions into groundbreaking products.

1.844.4AVIENT
www.avient.com