Realistic Prototypes in Less Time with Multi-Material 3D Printing

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THE 3D PRINTING SOLUTIONS COMPANY

EVERY 3D PRINTING AND ADDITIVE MANUFACTURING
TECHNOLOGY AND SOLUTION

FROM SYSTEMS TO SERVICE

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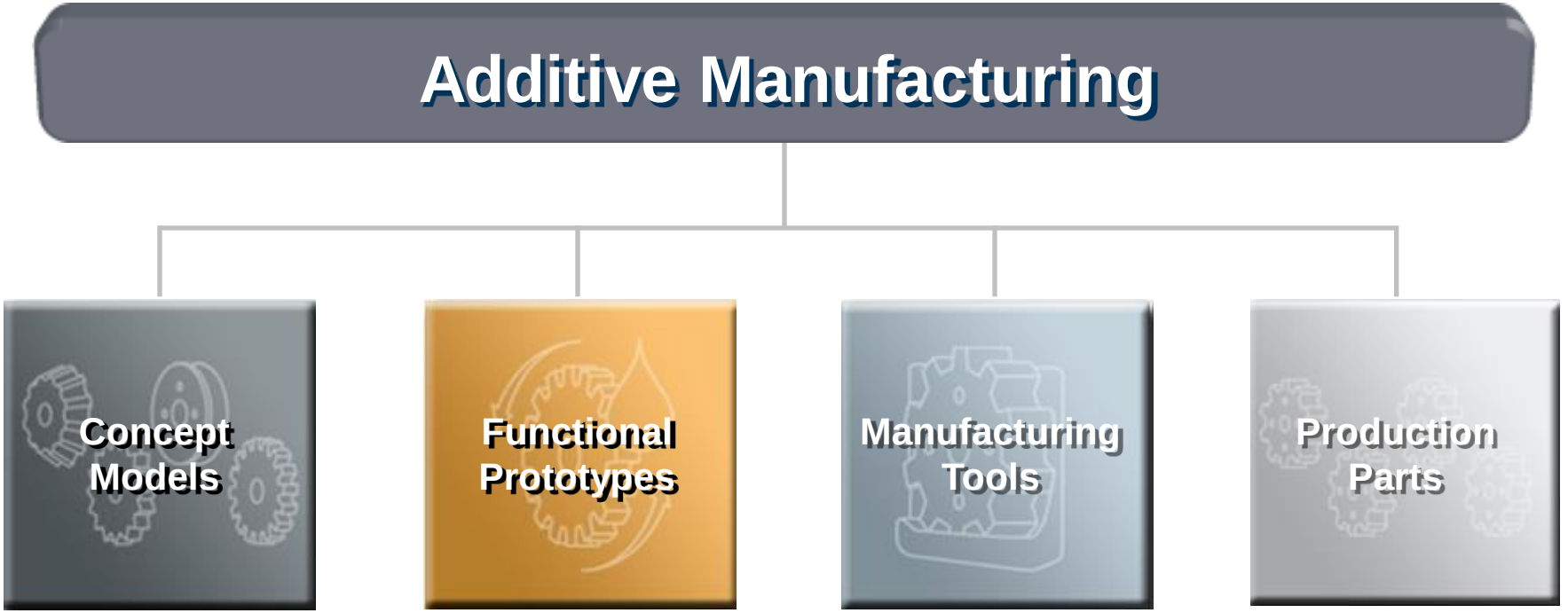
Applications for Additive Manufacturing



Established / Traditional

(Design)

Direct Digital Manufacturing

(Manufacturing)

Multi-Material 3D Printing

Application Compatibility (0 – N/A, 1 – Low, 5 – High)			
	Idea	Design	Production
PolyJet	-	5	5
FDM®	-	-	-

One-step production of prototypes with:

- Rigid regions
- Rubber-like regions
- Translucent regions
- Varying colors

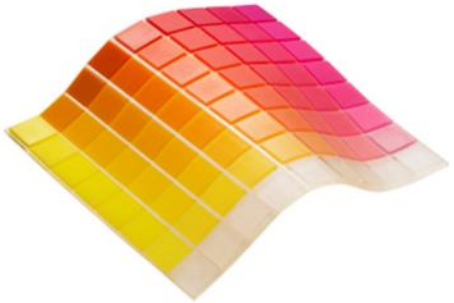
One-step production of multiple prototypes with:

- Different properties
- Different colors

Purpose

- Product realism
- Eliminate secondary operations
- Maximize printer utilization

Multi-material, multi-color bicycle helmet.



Example of color and transparency options available with rubber-like materials.

Agenda

Application Overview

Traditional Process

PolyJet Process

PolyJet Best Fits

Benefits

Customer Success Story

Multi-Material 3D Printing Overview

Digital Materials (DM)

- Composite materials
  - Two or three FullCure® model materials
  - Specific concentrations and structures
- Each combination produces unique properties (physical, mechanical, shades and tones, etc.)
  - Different from those of the parent materials

Two main categories of digital materials:

Rigid
Digital materials whose primary material is **Vero™**

Flexible
Digital materials whose primary material is **Tango™**

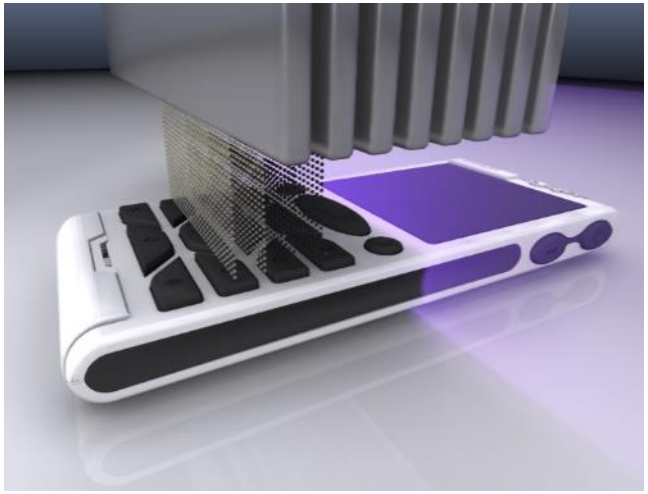


Illustration of PolyJet triple-jetting process.

Multi-material artistic piece (Vero white and TangoBlackPlus™).

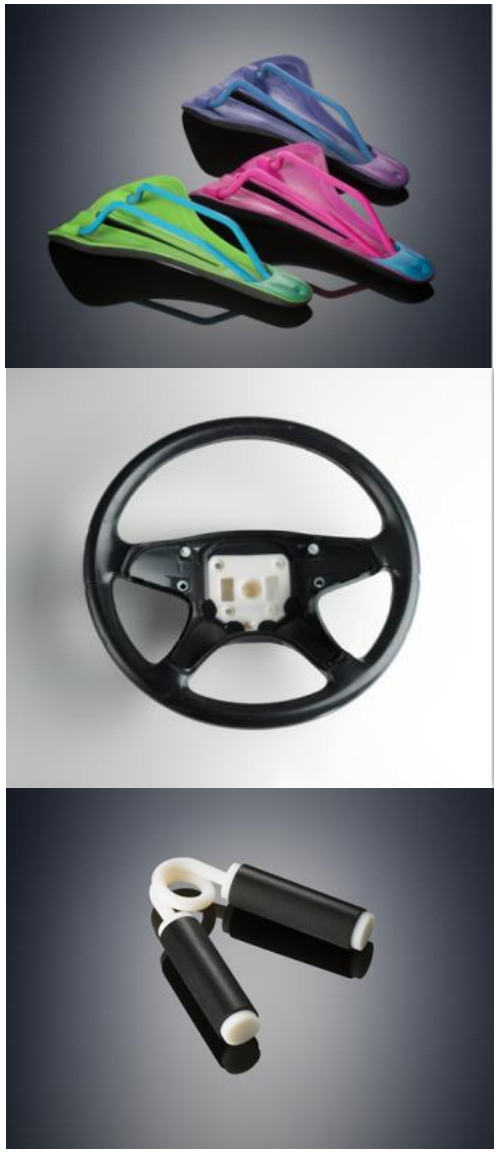
Where It's Used

Most industries

- Sporting goods
- Consumer electronics
- Automotive
- Medical
- Toys and gaming
- Housewares
- Entertainment
- Arts and fashion

Throughout the product development process

- Concept modeling
- Functional testing



Companies Benefitting

Bicycles

Automobiles

Design Reality
ideas at work

Product Design & Development

Athletic Goods

Industrial Plastic Fabrications Ltd

Plastic Machining and Fabrication

Plumbing & Sanitary Products

Consumer Products

Special Effects/Character Creation

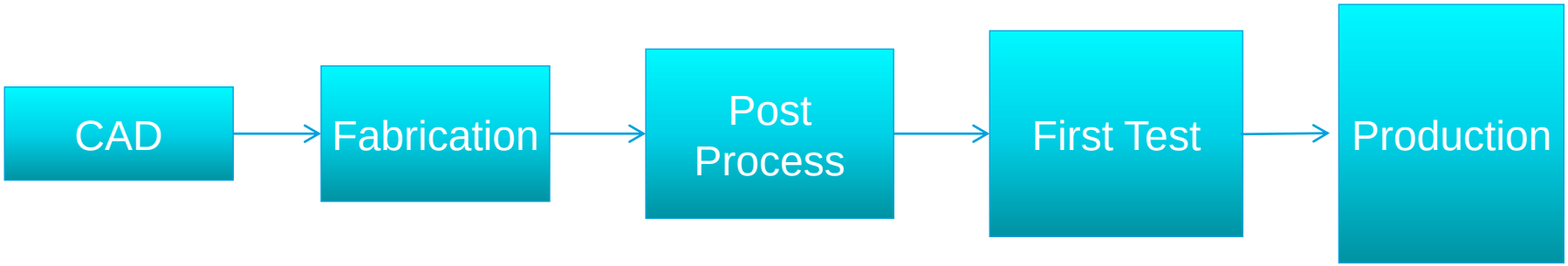
Traditional Process

Multi-stage process

- Fabrication
  - Hand work, CNC
- Post process
  - Painting, gluing, machining
- Assembly

Challenges

- Time consuming
- Dependent on outsourcing (expertise)
- Confidentiality issues



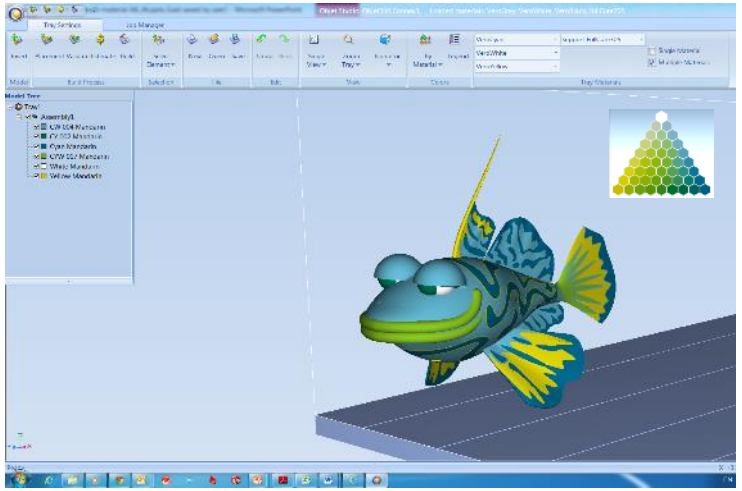
PolyJet Process

Design model in CAD

Prepare files

- Create shells per material
  - In CAD/STL editing software
- Import assembly into Objet Studio™ software
- Assign materials

Print



Preparing for multi-material printing in Objet Studio.

PolyJet is a Best Fit When:

Applications:

- Concept modeling/presentation
- Prototyping/light-functional testing
- End-use parts
  - Special effects
  - Jigs & fixtures
  - Gaming, figurines

Part characteristics:

- Approximate/simulate production goods
- High detail and complexity
- Engage the senses – sight and touch
- 1 to 100 needed

Rigid (orange) digital material with rubber-like overmolding.

Rigid and rubber-like combination for living hinge and snap fit simulation.

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PolyJet Best Fit Applications

Overmolding

- Combines two or more materials in a part
- Typically rigid plastic & rubber–like elastomer

Uses

- Power tools, medical devices
- Consumer electronics, kitchenware
- Toothbrushes, razors
- Jigs & fixtures

Characteristics

- Simulate
  - Plastic
  - Rubber/elastomer (Shore A 27 – 95)

Cross-sections of steering wheel using rigid and rubber-like materials.

Screwdriver handle with rubber-like interfaces.

Plumbing fixture with rubber-like overmolding.

PolyJet Best Fit Applications

Rubber simulation

- Visual and functional prototyping

Uses

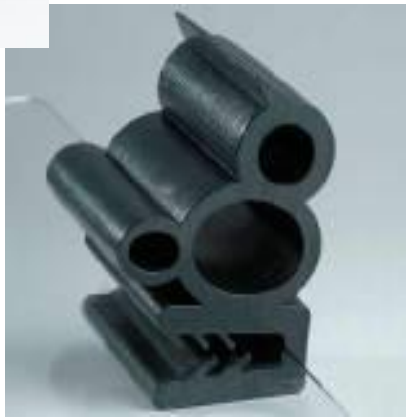
- Seals, gaskets (low pressure)
- Door and window seals (home/auto)
- Keypads
- Grips, cushions, pads

Characteristics

- Shore A between 27 and 95
- Black, translucent and a variety of colors
- Moderate tensile/flexural loads
- Moderate duty-cycle testing (<100)

Wrist rest.

Rubber tracks for a scale model.



Compression seal.

PolyJet Best Fit Applications

Labeling

- Print text and graphics

Uses

- Production-like markings
- Product identifiers (part #)
- Instructions and usage guides
- Branding

Characteristics

- Fine lines and small fonts
  - Lines: ≥ 0.2 mm (0.008 in)
  - Text: ≥ 0.8 mm (0.03 in)
- Rigid or rubber-like
- All available colors

Clear syringe printed with dosage markings.

3D printed calculator has printed keypad symbols and numbers.

PolyJet Best Fit Applications

Transparent / translucent + opaque

Uses

- Medical models (education, pre-surgical planning)
- Engineering models (fluid flow, demonstration)
- Marketing models (visualization, product realism)
- Art and entertainment (special visual effects)

Characteristics

- Tinted translucent items (requires Connex3™)
- Clear & opaque combinations
- Full transparency (with post processing*)
- Not suited for optics

**For better translucency, the transparent models must be polished.*

Shower head with clear body for visualization.

Eyeglass printed with opaque frame and clear lenses.

Medical model illustrating bone structure.

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PolyJet Best Fit Applications

Multi-color

- Final product realism

Uses

- Sales/marketing samples
- Industrial design concepts
- Product development
  - Heat/color maps (FEA analysis)
  - Component identification

Characteristics

- Palette-based
  - Light hues/dark hues
  - Monochrome (color+black+white)
  - Translucent color
  - Flexible color
- > 2 mm (0.8 in) thickness (for true colors)

Multi-colors used for product realism.

Example of color bleed for 0.5 – 2.5 mm (0.02 – 0.10 in).

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PolyJet Benefits

Mixed tray

- Simultaneous printing
  - Multiple parts
  - Multiple materials

Composite Material

- Digital ABS™ and Digital ABS2™

Parts printed with different materials in a single job.

Digital ABS materials with TangoBlackPlus simulating overmolding.

PolyJet Benefits

Shortening the design cycle

- More iterations in less time
- Identify errors early

Simple and efficient

- One process vs. multiple operations
- One part vs. assembly of multiple parts

Final product realism

- Color and properties
- Freedom of design

Time & cost reductions

- 50% - 90%
- Increased productivity (fewer material swaps)

Rubber keypad printed in multiple colors.

Eyewear printed with tinted lenses and multi-color frames.

Typical time and cost savings derived from numerous end-user analysis, testimonials and feedback. Actual savings may vary based upon numerous factors, including traditional time/cost, part geometry and utilized technology.

CASE STUDY

Trek Bicycles

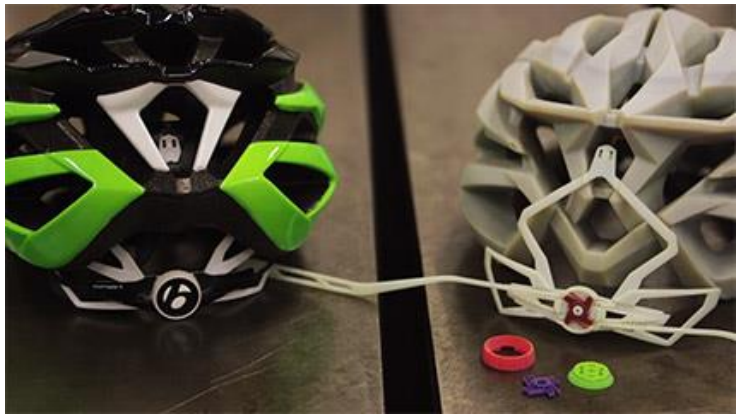
Case Study: Trek Bicycles

Bicycle components and accessories

- Design evaluation & trial rides
- Communication, visualization

Need: Look & feel like production parts

- Helmet and grip



Prototype helmets.

Functional handlebar grip prototype produced using rubber-like TangoBlackPlus.

Case Study: Trek Bicycles

Bicycle components and accessories

- Design evaluation & trial rides
- Communication, visualization

Need: Look & feel like production parts

- Helmet and grip
- Saddles and chain guard

Saddles with rigid and rubber-like regions (Vero + TangoBlackPlus).

Chain protector and sound guard produced using Digital ABS and rubber-like TangoBlackPlus.

Case Study: Trek Bicycles

Bicycle components and accessories

- Design evaluation & trial rides
- Communication, visualization

Need: Look & feel like production parts

- Helmet and grip
- Saddles and chain guard

Used multi-material, multi-color 3D printing

- Saddle – pressure mapping
- Others - Digital ABS & rubber-like

Benefits

- Improved durability & visualization
- Improved productivity
- Eliminated bonding
- More printer uptime

Multiple colors representing a pressure map (Vero).

Chain protector and sound guard produced using Digital ABS and rubber-like TangoBlackPlus.

Summary: Multi-Material 3D Printing

Who
- Manufacturers
- Design firms
- Service bureaus

What
- One-step, multi-material prototypes

When
- Communications → evaluations

Why
- Look and feel of final products
- Breadth of materials & colors
- More uptime & utilization

Multi-color bicycle helmet.

Multi-material, multi-color razor handle.

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More Information and Resources

www.stratasys.com/webinar-multi-material

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