

Material and Manufacturing Process Selection Criteria for Automotive Product Development

by

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Presentation Introduction

The objective of this presentation is to provide an overview of how and why plastic composite materials are incorporated into vehicles, from the viewpoint of a Tier 1 automotive supplier.

Why Plastic Composites in Automotive Applications?

What is the impetus for the Automotive OEM's to use plastic composite materials?

- ▶ **Cost Savings**
- ▶ **Weight Reduction**
 - CAFE standards
 - Gas prices
- ▶ **Quality Improvement**
 - JD Power metrics
 - Consumer Reports
- ▶ **Program Timing Improvement**
 - Computer modeling & simulation
- ▶ **Function (Performance) Enhancement**
 - Insurance Institute for Highway Safety (IIHS)
 - Federal Motor Vehicle Safety Standards (FMVSS)



Automotive OEM Identifies Product Need

How do OEM's define their product needs?

▶ **Product and Manufacturing Process Specified**

- Typically, the OEM has designed the part and is requesting supplier quotations
- Oftentimes, the OEM is open to alternative concepts

▶ **Product Performance Specified**

- Cost & mass targets given
- Design & Development Verification Plan provided
 - Static & dynamic load cases
 - Durability requirements
 - Weathering requirements
 - Thermal cycling
 - Specific performance specification criteria
- OEM supplier is free to choose a material and process to fit the application

Timing of OEM Request

When in the product life cycle does the OEM request supplier input?



▶ **Advanced Development Project**

- Research and development, no specific program targeted
- Moving a new technology to “bookshelf” technology

▶ **Program Concept Phase**

- A specific vehicle platform is under concept development
- Expected product function is being defined



▶ **Pre-Prototype Phase**

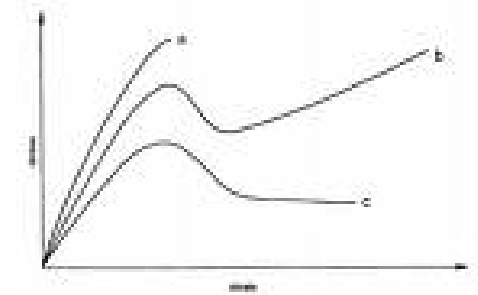
- Product is fundamentally designed
- Usually a preferred manufacturing method and material is already assumed



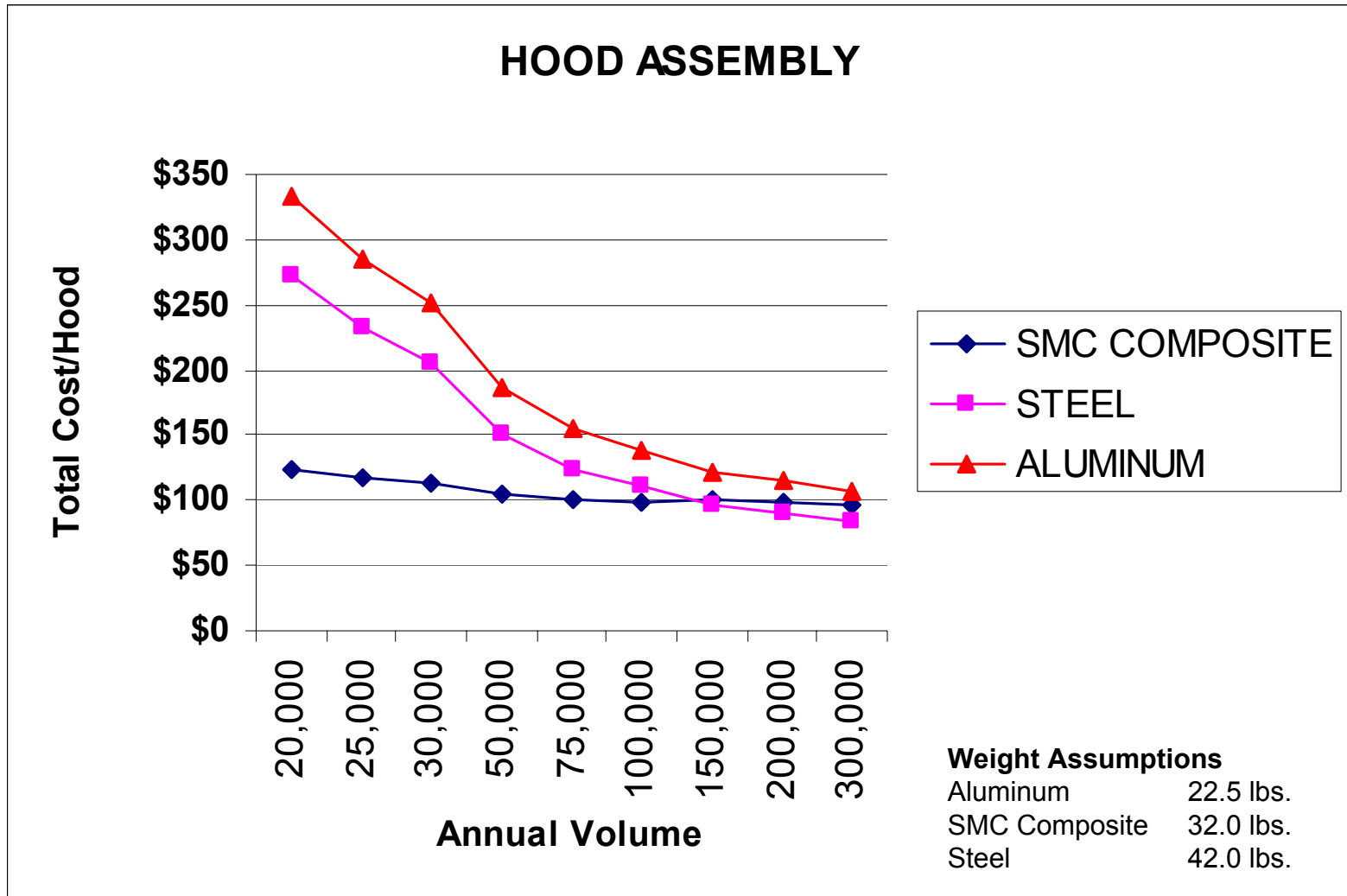
Key Factors Determining Manufacturing Process and Material

What manufacturing process and material best fits the OEM's need?

- ▶ Annual Production Volumes
- ▶ Tooling Investment
- ▶ Thermal Environment
- ▶ Strength
- ▶ Impact
- ▶ Weathering/UV Stability



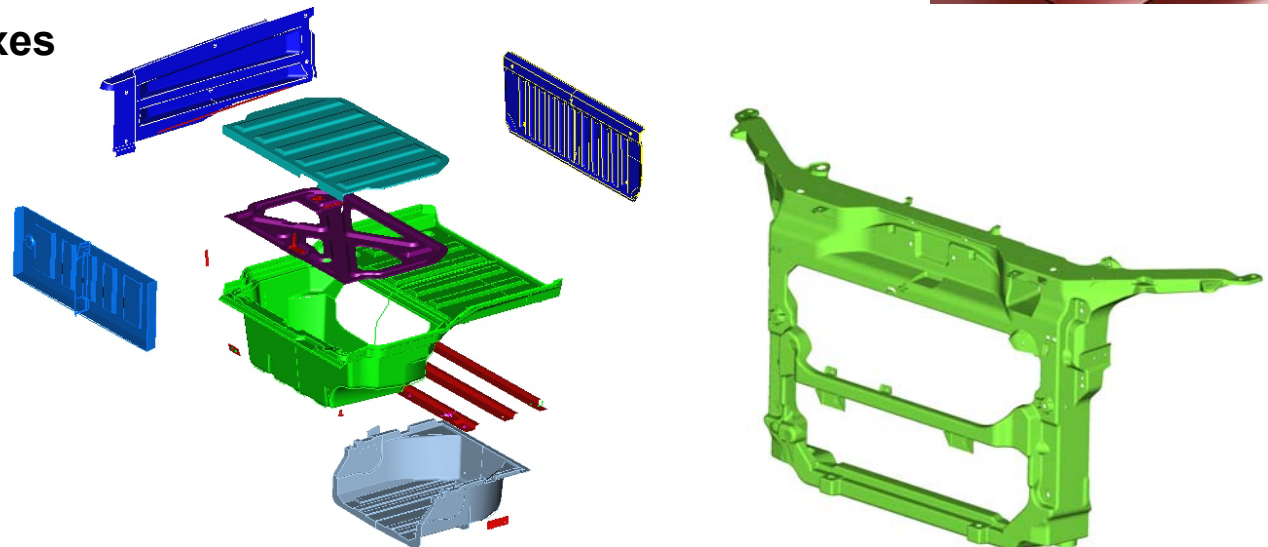
Case Study – Hood Assembly



Where is the market going?

What plastic composite products are automotive OEM's interested in?

- ▶ Underbody aero shields
- ▶ Front-end Bolsters
- ▶ SMC body panels
- ▶ Battery Trays (both electric/hybrid and conventional vehicles)
- ▶ Underbody Stowage and Tire Tubs
- ▶ Pick-up truck boxes
- ▶ Roof systems
- ▶ Bumper systems



Where is the market going?

What plastic composite materials are automotive OEM's interested in?

- ▶ **Direct Compounded Long Fiber Thermoplastics (DLFT)**
 - Tier 1 supplier compounds at manufacturing site reducing material costs
 - Compression molded parts have improved strength & impact properties
- ▶ **Sheet Molding Composite (SMC)**
 - Raw material price relatively stable, continually getting more competitive
 - Strong contender for production volumes less than 100K units/yr
- ▶ **Carbon fiber**
 - Material price is much too prohibitive for commonplace utilization
 - Strong desire to have a class "A" carbon fiber body panel at an affordable price

Impediments to Incorporation of Plastic Composites

What roadblocks exist that prevent automotive OEM's from using plastic composites?

- ▶ **Many product engineers are not familiar with composites**
- ▶ **Price comparisons using a steel design as a baseline**
- ▶ **Computer Aided Modeling (CAE) methods for plastic composites needs improvement**



Summary

The future of plastic composites for automotive applications is bright!

- ▶ **OEM's are giving composite plastics more consideration to shed weight**
- ▶ **OEM's are finding that plastic composites offer both weight and cost savings**
- ▶ **Hybrid/Electric vehicles are a “game changer” in favor of composites**
- ▶ **Continue to educate the OEM's about plastic composites**

Thank you!